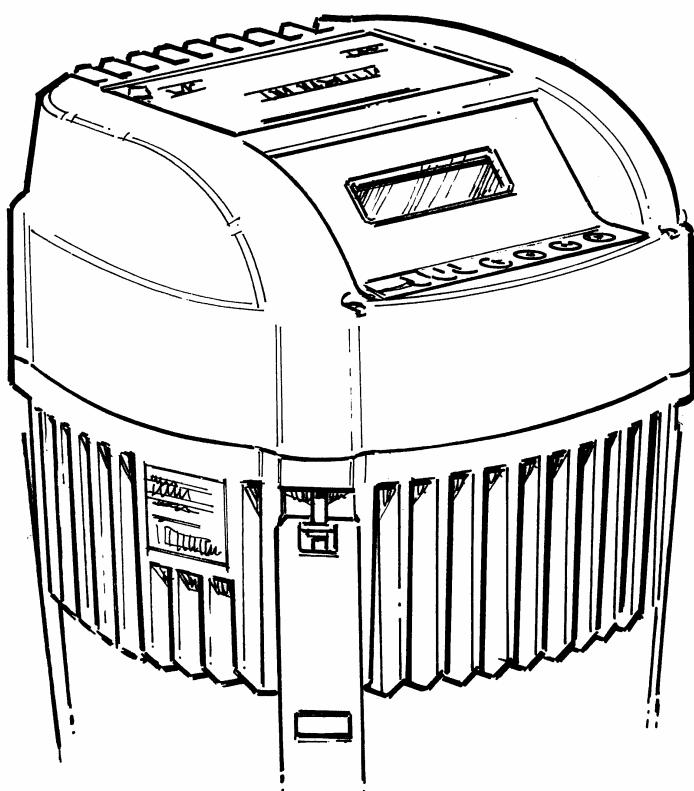


Operating Instructions

HYDROVAR®

HV 2.015 / 2.022
HV 4.022 / 4.030 / 4.040
HV 4.055 / 4.075 / 4.110



V 200710A

771079412 Manual HV 2.015-4.110

ENGLISH

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Follow the pump operating and maintenance instructions
We reserve the right to alter specifications



1 Important safety instructions



Read and follow the operating and safety instructions carefully before starting operations!

All modifications must be done by qualified technicians!



Warns that failure to observe the precaution may cause electric shock



Warns that failure to observe the precaution may cause personal injury or damage to property.

In addition to these operating instructions please pay attention to universal safety and accident prevention regulations.

Basically the HYDROVAR must be disconnected from the power supply before any work can be carried out in the electrical or mechanical part of the system.

Installation, maintenance and repair work may be carried out only by trained, skilled and qualified personal.

Unauthorized modifications or changes to the system make all guarantees null and void.

During operation, the motor can be stopped by opening digital input or manual operation whereby the HYDROVAR and the motor remain under voltage. For safety reasons, the HYDROVAR has to be disconnected from the power supply when carrying out work on the machinery.



When the HYDROVAR is connected to the power supply, the components of the power unit as well as certain components of the control unit are connected directly to mains.

Touching these components seriously endangers life!

Before removing the HYDROVAR cover the system must be disconnected from the power supply. After switching off the power supply wait **at least 5 minutes** before starting work on or in the HYDROVAR (the capacitors in the intermediate circuit are discharged by the internal discharge resistors).

Voltages of up to 800 volts are possible (in case of error these also can be higher)

All work, carried out at opened HYDROVAR, may only be performed by



qualified and authorized staff.

Furthermore, it has to be taken care not to short circuit the neighboured components when connecting the external control wires. All cable ends which are not in use have to be isolated.



The HYDROVAR contains electronic safety devices which switch off the control element in the event of faults, whereby the motor has zero current but remains energised and comes to a halt. The motor can also be halted by mechanical blocking. If it is switched off electronically the motor is current less from the mains voltage through the electronics of the HYDROVAR but is not potential-free in the circuit.

In addition voltage fluctuations, especially power failures can cause the system to switch off itself.

Repair of faults can cause the motor to start up again automatically!



The system may only be put into operation when it has been grounded. In addition to that, equipotential bonding of all conductive pipes must be ensured.

Please consider local installation standards!



High voltage tests of the HYDROVAR or the motor may damage the electronic components! Hence bridge the in- and outgoing terminals L1 - L2 - L3 / U-V-W before.

To avoid incorrect metering by capacitors incorporated in the electronic part isolate the motor from the HYDROVAR.



The operating instructions must be read, understood and followed by the operating personnel. We point out that we accept no liability for damage and operating disorders which are the result of non-compliance with the operating instructions.



**Transport, handling, storage, disposal:**

- Check the HYDROVAR immediately after delivery/receipt for damage or missing parts
- The HYDROVAR unit must be transported carefully.
- Avoid serious impacts

NOTICE!

The use of the WEEE symbol indicates that this product may not be treated as household waste.

Dispose of all packing materials and the HYDROVAR unit in accordance with local regulations. For more detailed information about the recycling of this product, please contact your local authority, your household waste disposal service provider or the shop where you purchased the product.

CAUTION!

Lifting aids (stacker, crane, crane mounting device, lifting blocks, sling ropes, etc.) must have the proper dimensions so that they can bear the weight of the HYDROVAR.

CAUTION!

It is not allowed to carry the HYDROVAR around by using the connected cables.

Do not damage the cable during transport (do not squeeze, bend or drag).
The cable ends must be kept dry.

WARNING!

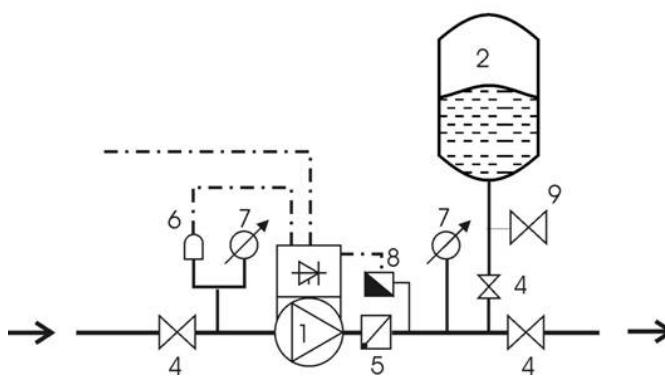
- Do not stand underneath suspended loads
- Take note of the general regulations on prevention of accidents
- The HYDROVAR must be secured against tipping over and slipping until it has been fixed in its final location.



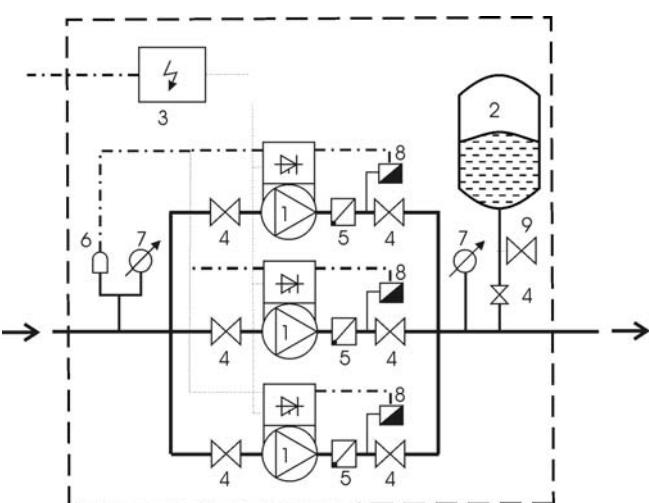
2 System design

The following diagrams show typical single pump and multi-pump systems using the HYDROVAR. Connection can be made directly to a water supply. In such a case, a pressure switch on the suction side should be used.

Single pump layout



Multi pump layout



- (1) pump with HYDROVAR
- (2) diaphragm tank
- (3) distribution panel

- (4) gate valve
- (5) non return valve
- (6) low water control

- (7) pressure gauge
- (8) pressure transmitter
- (9) drain tap

2.1 Pressure tank

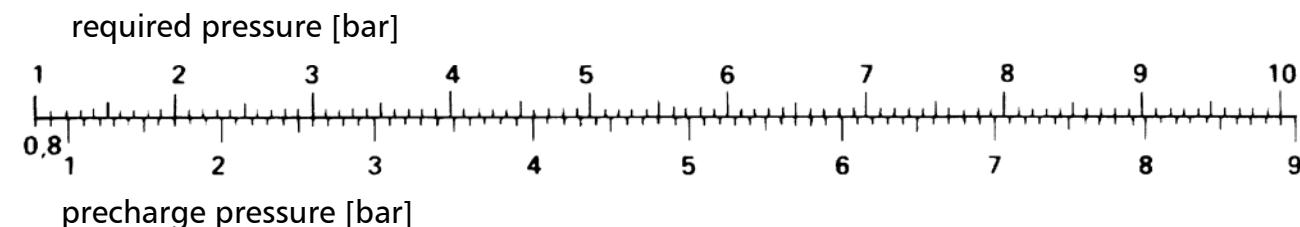
A diaphragm pressure tank is used on the discharge side of the pump to maintain pressure in the line when there is no water demand. This avoids the pump from continuing to run at zero demand. With the HYDROVAR, no large tanks are required for supply purposes. The tank must be permitted and suitable for systems pressure. The tank should have a capacity of min. 10% of the maximum system flow rate [l/min] of one pump (also valid for multi-pump system).

Example:

Maximum flow rate of the pump = 250 litres per minute

Minimum volume of the tank = $250 \times 0.10 = 25$ litres

The pre-charge pressure of the tank can be determined by using the following table:



NOTICE: To check and set the right pre-charge pressure, please make the tank unpressurised before.

3 Product overview

3.1 Hardware configurations

The HYDROVAR modul concept basically consists two main parts: the power unit and the control card. In its basic configuration (consisting of only the power unit) the HYDROVAR can be used as Basic Inverter. In that configuration the HYDROVAR can be used as a sequence pump in a multi pump system, but also as a simple soft starter for single pump applications.

By extending this "Basic Inverter" with the additional control card, the HYDROVAR is able to work in different modes and can be extended additional.

Basic Inverter – HYDROVAR in its simplest configuration.

Application: Single pump operation as soft-starter, sequence pump in a multi pump system

Master Inverter – Full featured HYDROVAR including the high level control card (supports also the optional modules like the Relay Card and all special software features).

Application:

- Single pump control including all extended features
- Multi pump system of "Master" and "Basic Inverters" (up to 8 pumps)
- Multi pump system equipped with up to 8 "Master Inverters"
- in combination with the optional Relay Card up to 5 fixed speed pumps can be controlled

Single Inverter – HYDROVAR with control card developed only for single pump operation and less features in comparison with the Master Inverter. Therefore the Single Inverter isn't able to support any optional modules like the Relay Card.

Application:

- Single pump control

3.2 Operation modes

3.2.1 Actuator (for single pump operation only!)

In this mode the HYDROVAR operates as an actuator with external speed signal or switching between 2 programmed frequencies by using the corresponding digital input. For this application the HYDROVAR operates like a standard frequency converter when an external controller is used.

Please consider that this mode is only possible by using a HYDROVAR Master or Single Inverter and is limited for single pump operation only

3.2.2 Controller

This mode should be selected if only one HYDROVAR pump is in operation and there is no connection to any other HYDROVAR via RS485 interface.

→ Typical single pump operation

3.2.3 Cascade Relay

One pump is fitted with a HYDROVAR Master Inverter and up to 5 slave pumps can be switched ON and OFF on demand. For this purpose an additional Relay Card with 5 relays is used in the Master Inverter.

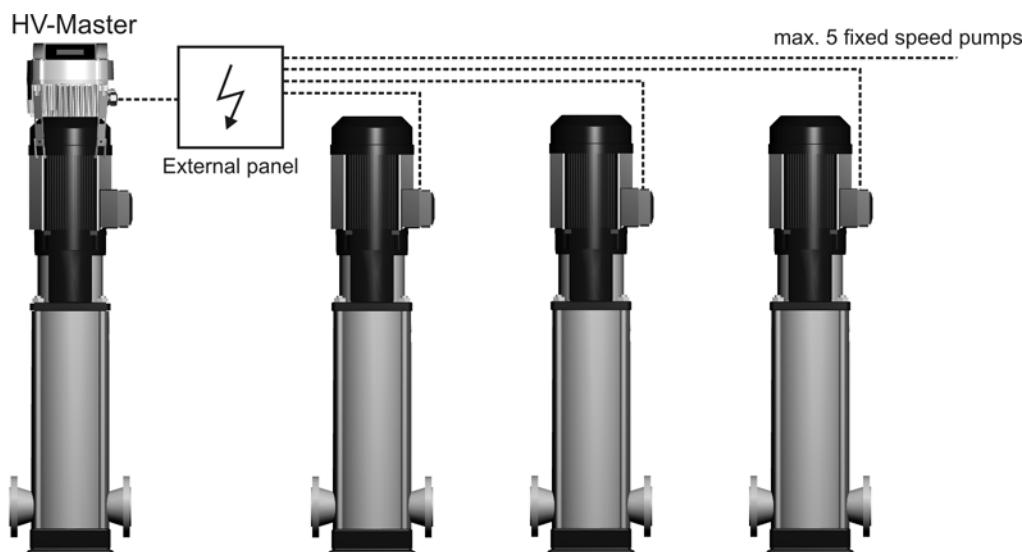
Basically an external switchboard is needed for all the motor relays, because the relays in the HYDROVAR are not able to switch the pumps directly as they are just used as control contacts.

Also an automatic change over of the fixed speed pumps to provide even wear and achieve even operating hours is possible in this mode.

This configuration is a cost effective alternative compared with other solutions using VFD's on each pump, but in any case care has to be taken due to the lower reliability of such a system.

Application example

Booster sets up to 6 pumps where only one pump is speed controlled by the HYDROVAR and the others are fixed speed (1 HYDROVAR Master Inverter+5 fixed speed). This should be the standard configuration when the additional Relay Card is used.



3.2.4 Cascade Serial

In this mode there are various possibilities to combine the different versions of the HYDROVAR, which will be explained on the following pages.

In general each of the pumps is equipped with a HYDROVAR unit. All units are connected via the RS485 interface and are communicating via standard MODBUS-protocol (9600 Baud, RTU, N81).

To realise a fully controlled system at least one "Master Inverter" is needed, the other pumps could be fitted just with a "Basic Inverter".

The controller in the "Master Inverter" is continuously informed about the status and failures of the "Basic Inverters". All failures are indicated on the master unit, including also the date and time stamp.

The complete control will be done via the "Master Inverter" every time, but also an automatic change over of the lag pumps to provide even wear and achieve even operating hours is provided.

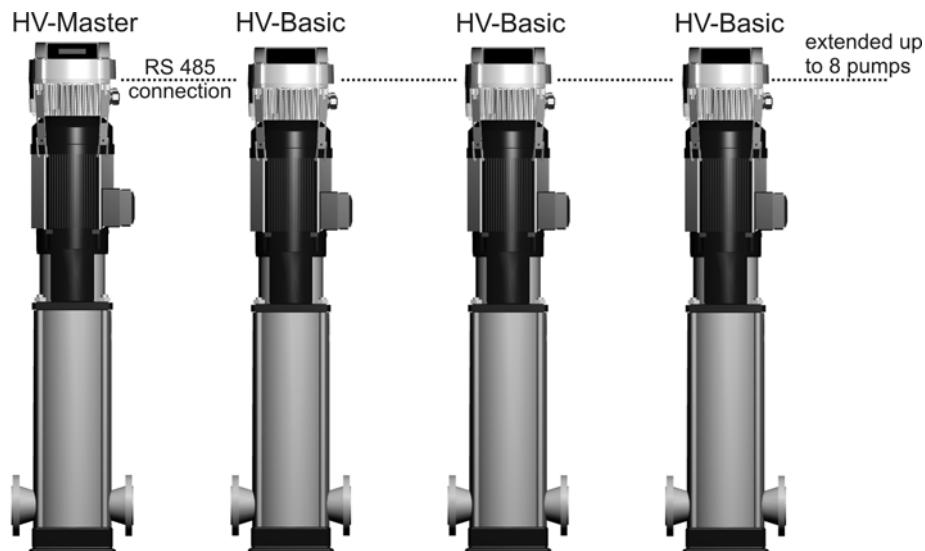
If the control card of a "Master Inverter" fails, each of the "Basic Inverters" can be manually started by an external switch (manual operation) in order to ensure an "emergency operation" of the system.

Application Example

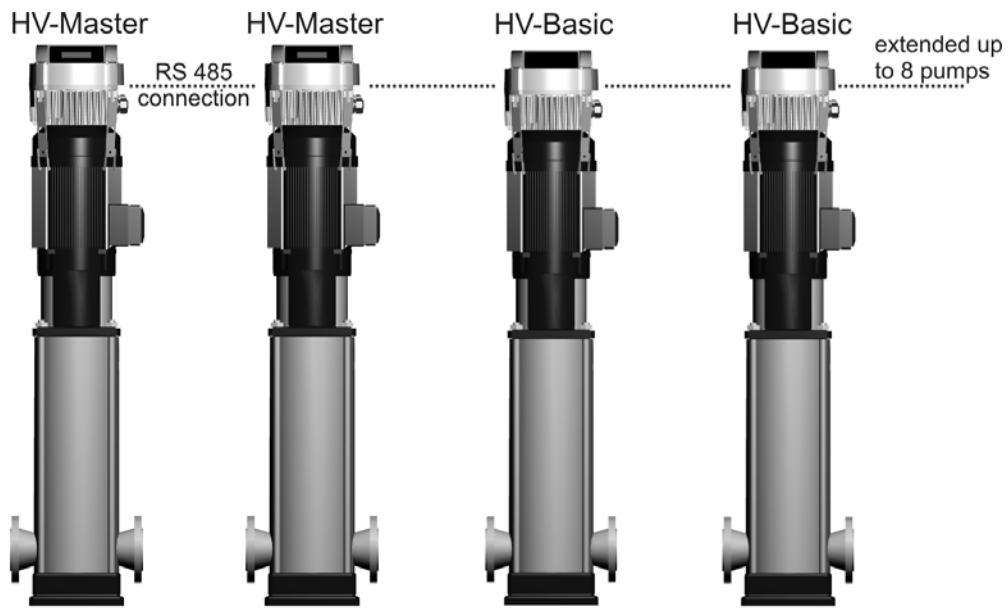
Each pump of the system (up to 8 pumps) is equipped with a HYDROVAR unit (at least one "Master Inverter" and the others can be "Basic Inverters" in order to ensure a proper control of the system) which are connected via the serial interface.

The combination of the different HYDROVAR units that are used in a multi-pump-system depends on the system requirements (i.e. in a 6 pump system 2 "Master Inverters" can be used due to reliability reasons and 4 "Basic Inverters" without control card – or just any other configuration)

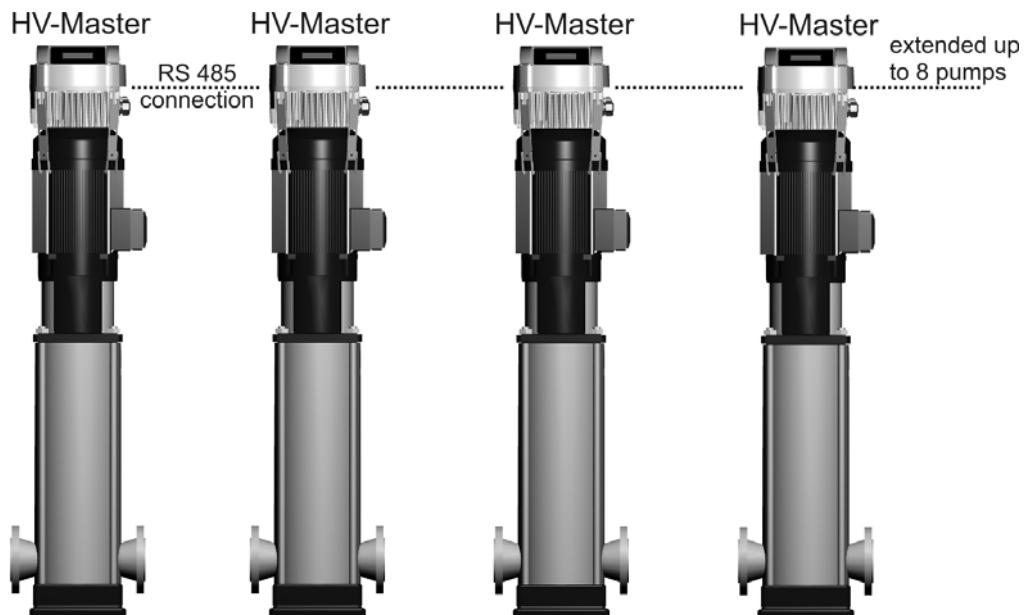
Minimum requirement: 1 "Master Inverter" and the others equipped with "Basic Inverters"



To increase the operating reliability of such a system, also a second "Master Inverter" is recommended:



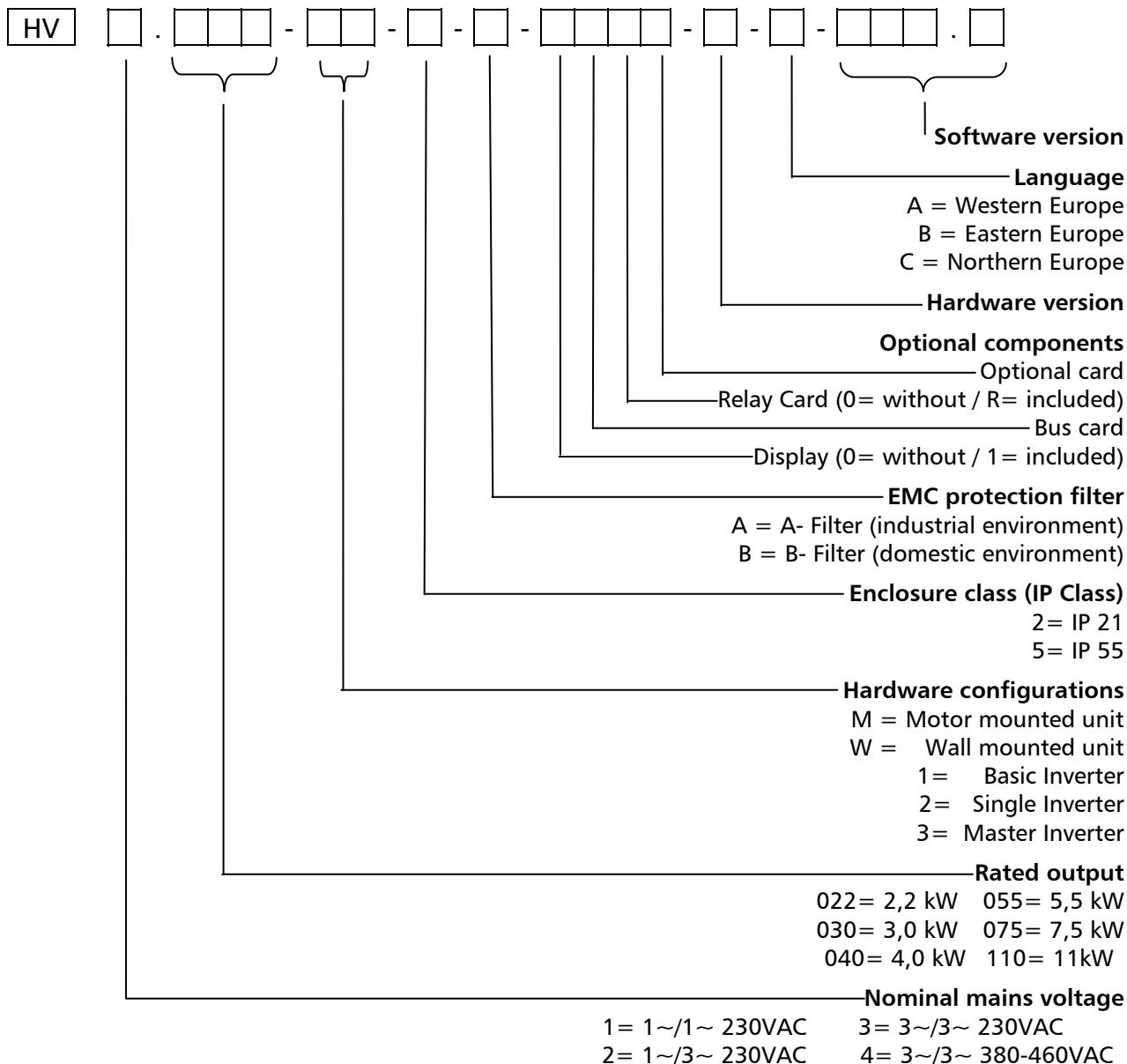
Full-featured Possibility: Each pump is equipped with a "Master Inverter"



In this mode it is possible to run all pumps in multi-controller mode and synchronous mode as well.

This configuration allows each pump of the system to become the lead pump. This ensures a proper operation if one "Master Inverter" fails. In this case another HYDROVAR takes control. That ensures that the operating hours of each separate pump will be on the same level to ensure even wear of the pumps.

4 Type designation code



Example

HV 4 . 0 4 0 - M 3 - 5 - B - 1 0 R 0 - G - A - V 0 1 . 1

The mentioned HYDROVAR in this example is specified with following technical data:

| | |
|--------------------------|--------------------------------------|
| Nominal mains voltage: | 3~/3~ 380-460VAC |
| Rated output: | 4 kW |
| Hardware configurations: | Motor mounted unit - Master Inverter |
| Enclosure class: | IP 55 |
| EMC-filter: | B - Filter (domestic environment) |
| Optional components: | Display, Relay-Card |
| Hardware version: | G |
| Language: | A (Western Europe) |
| Software version: | V01.1 |

5 Technical Data

| HYDROVAR | | Power supply | | | |
|----------|--------------|----------------------------|-----------------------|-----------------------------|-----------------------|
| Type | Rated output | Voltage limits 48-62 Hz | nominal current input | Recommended line protection | Maximum cross-section |
| HV | [kW] | [V] | [A] | [A] | [mm ²] |
| 2.015 | 1,5 | 1~230 ± 15% | 14,0 | 20 | 10 |
| 2.022 | 2,2 | | 20,0 | 25 | |
| 4.022 | 2,2 | 3~380-460 ± 15% | 7,6 | 13 | 10 |
| 4.030 | 3 | | 9,1 | 13 | |
| 4.040 | 4 | | 11,4 | 16 | |
| 4.055 | 5,5 | 3~380-460 ± 15% | 15,1 | 20 | 10 |
| 4.075 | 7,5 | | 19,6 | 25 | |
| 4.110 | 11 | | 27,8 | 32 | |

| HYDROVAR | | Output to the motor | | |
|----------|--------------|---------------------|------------------------|-------------------------|
| Type | Rated output | max. output voltage | nominal current output | Motor connection cables |
| HV | [kW] | [V] | [A] | mm ² |
| 2.015 | 1,5 | 3x U _{in} | 7 | 4x1,5 – 4x4 |
| 2.022 | 2,2 | | 10 | |
| 4.022 | 2,2 | 3x U _{in} | 5,7 | 4x1,5 – 4x4 |
| 4.030 | 3 | | 7,3 | |
| 4.040 | 4 | | 9 | |
| 4.055 | 5,5 | 3x U _{in} | 13,5 | 4x2,5 – 4x6 |
| 4.075 | 7,5 | | 17 | |
| 4.110 | 11 | | 23 | |

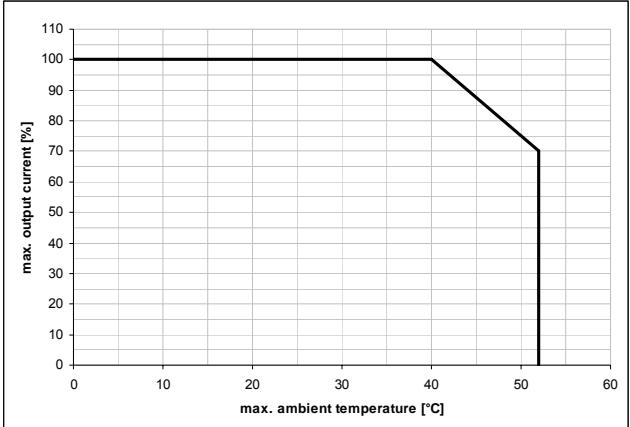


Make sure that the HYDROVAR's electrical data match those of the electric pump. Improper combinations may cause errors and malfunction and of the protection of the electric motor.

The nominal current of the motor must be lower than the rated current of the HYDROVAR to prevent overheating or shutdown due to "OVERLOAD".

The max. output current of the HYDROVAR could reach 110% of the nominal current for max. 60 sec. before the error "OVERLOAD" will occur.

5.1 General technical data

| Ambient temperature: | <p>0° C ... +40°C At higher temperatures a reduction of the output current or the use of the next HYDROVAR power size is necessary.</p>  <table border="1"> <caption>Data points estimated from the graph</caption> <thead> <tr> <th>max. ambient temperature [°C]</th> <th>max. output current [%]</th> </tr> </thead> <tbody> <tr><td>0 - 40</td><td>100</td></tr> <tr><td>40 - 50</td><td>70</td></tr> <tr><td>50</td><td>0</td></tr> </tbody> </table> <ul style="list-style-type: none"> ○ Protect the HYDROVAR from direct sunlight! ○ Outdoor installation without protection of the HYDROVAR is not permitted! | max. ambient temperature [°C] | max. output current [%] | 0 - 40 | 100 | 40 - 50 | 70 | 50 | 0 |
|-------------------------------|---|-------------------------------|-------------------------|--------|-----|---------|----|----|---|
| max. ambient temperature [°C] | max. output current [%] | | | | | | | | |
| 0 - 40 | 100 | | | | | | | | |
| 40 - 50 | 70 | | | | | | | | |
| 50 | 0 | | | | | | | | |
| Storage temperature: | -25° C ... +55° C (+70°C during 24 hours max.) | | | | | | | | |
| Humidity: | <p>RH max. 50% at 40°C, unlimited RH max. 90% at 20°C, max. 30 days per year 75% average per year (class F) Condensation is not permitted!</p> | | | | | | | | |
| Air pollution: | The air may contain dry dust as found in workshops where there is no excessive quantity of dust due to machines. Excessive amounts of dust, acids, corrosive gases, salts etc. are not permitted | | | | | | | | |
| Altitude: | <p>max. 1000m above sea level At sites over 1000 m above sea level, the maximum output power has to be derated by 1% for every additional 100m. If the installation site is higher than 2000 m above sea level, please contact your local distributor.</p> | | | | | | | | |
| Class of protection: | HV 2.015 / 2.022 HV 4.022 / 4.030 / 4.040 IP 55, NEMA 4 (Indoor use only) HV 4.055 / 4.075 / 4.110 | | | | | | | | |
| Certifications: | CE, UL, C-Tick, cUL | | | | | | | | |

5.2 EMC requirements (Electromagnetic compatibility)

The EMC requirements differ between two environments which depending on the intended use.

- **First environment – class B** (EN 61800-3: Class C2)

Environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes e.g. houses, apartments, commercial premises or offices in a residential building are typical examples of first environment locations.

Be careful: The relevant EMC regulations for which the HYDROVAR is tested in the first environment consider that the HYDROVAR is a restricted available product. That means the voltage of the inverter is less than 1 000 V, it is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a person or an organisation having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

- **Second environment – class A** (EN 61800-3: Class C3)

Environment that includes all establishments other than those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes e.g. Industrial areas, technical areas of any building fed from a dedicated transformer are typical examples of second environment locations.

The HYDROVAR complies with the general EMC regulations and is tested according to the following standards: EN 61800-3/2005

EN 55011 (2002) Disturbance voltages / Disturbance field strength

| | First environment – class B / class C2 | Second Environment – class A / class C3 |
|----------------------------|---|--|
| Disturbance voltages | OK | OK |
| Disturbance field strength | *) | OK |

*) Warning - In a domestic environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.

EN 61000-4-2 (2001) Electrostatic discharge
EN 61000-4-3 (2002) Electromagnetic field immunity test
EN 61000-4-4 (2001) Burst immunity test
EN 61000-4-5 (2001) Surge immunity test
EN 61000-4-6 (1996) Immunity of conducted RF-Disturbance
EN 61000-4-11 (2001) Voltage dips and interruptions

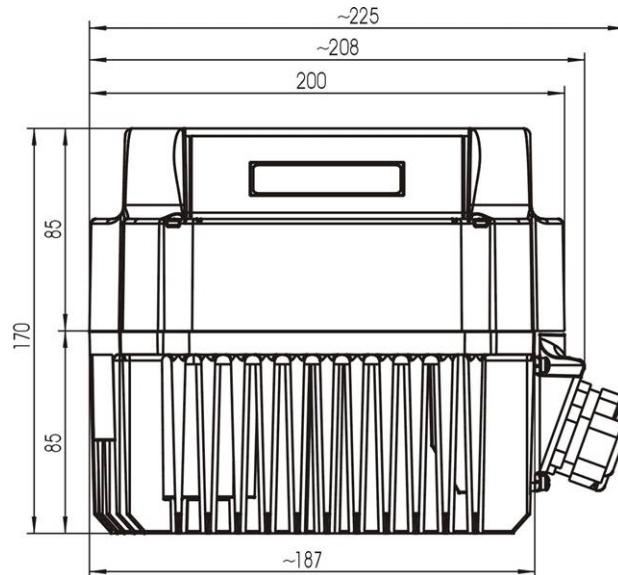
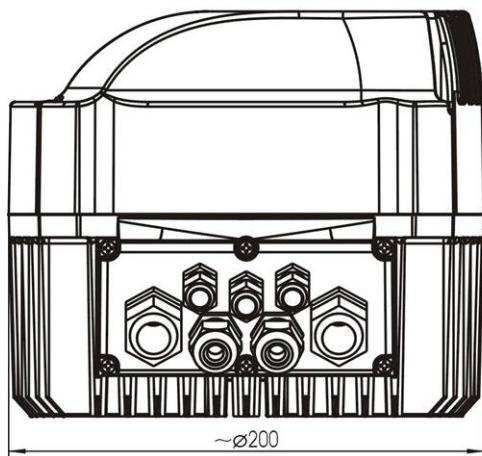


ITT

6 Dimensions and weights

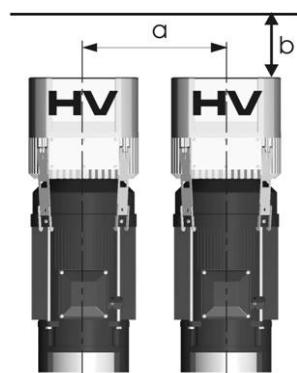
HV 2.015 / 2.022

HV 4.022 / 4.030 / 4.040



All dimensions in millimetres!
Lifting aids must have the proper dimensions.

Drawings are not in scale!



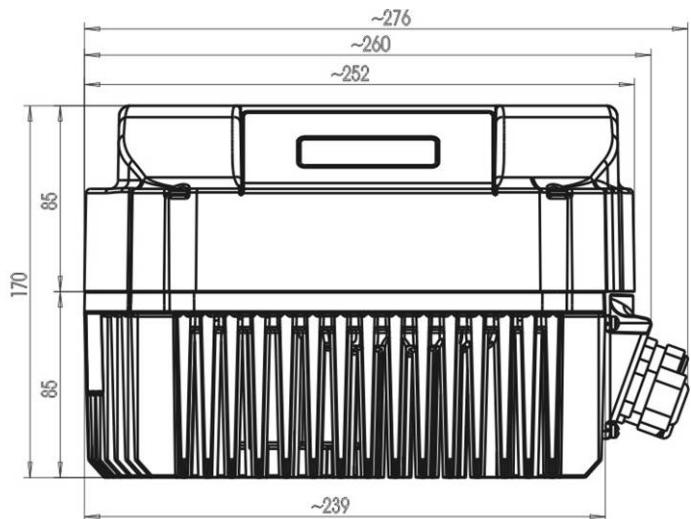
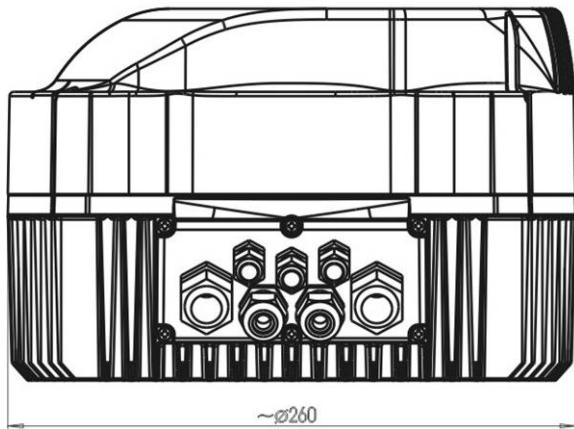
| Type | Weight [kg] | |
|----------|-------------|-------------------|
| | Basic | Master/ Single |
| HV 2.015 | | |
| HV 2.022 | | |
| HV 4.022 | 4,00 | 4,40 |
| HV 4.030 | | |
| HV 4.040 | | |

a ... minimum centre-distance between HYDROVARs

300 [mm]

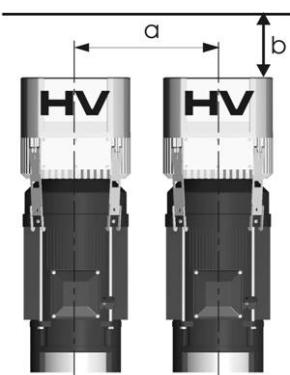
b ... expansion space for maintenance

110 [mm]

HV 4.055 / 4.075 / 4.110

All dimensions in millimetres!
Lifting aids must have the proper dimensions.

Drawings are not in scale!



| Type | Weight [kg] | |
|----------|-------------|-------------------|
| | Basic | Master/ Single |
| HV 4.055 | | |
| HV 4.075 | 7,70 | 8,10 |
| HV 4.110 | | |

a ... minimum centre-distance between HYDROVARs
b ... expansion space for maintenance

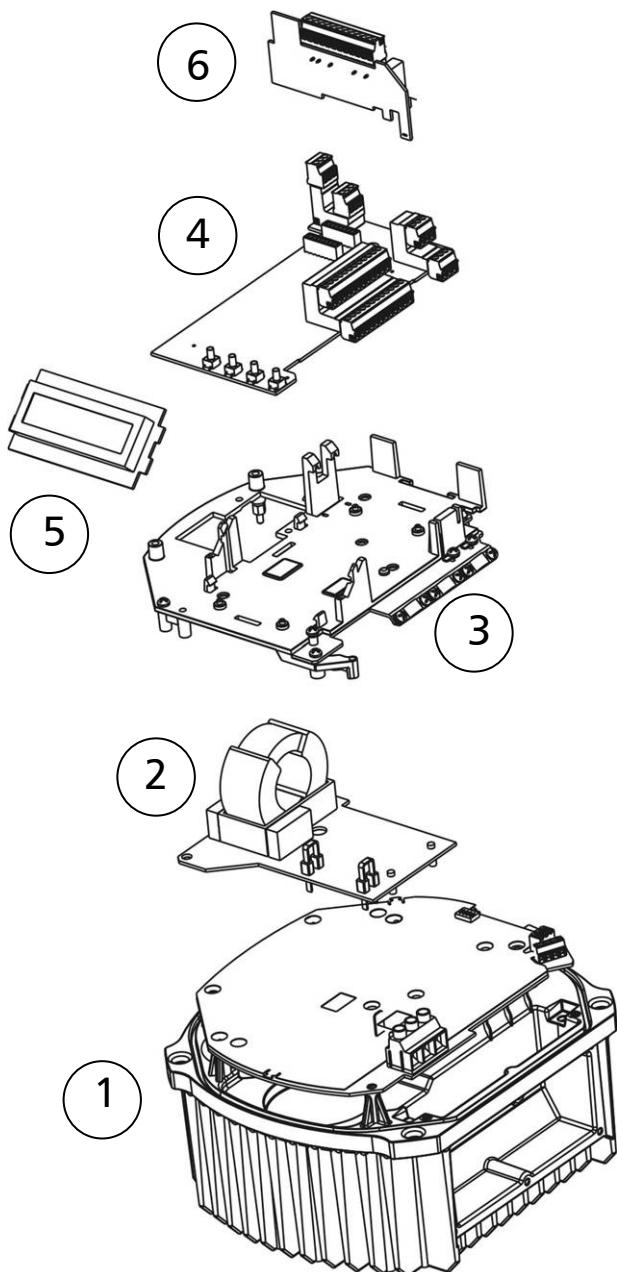
430 [mm]
110 [mm]



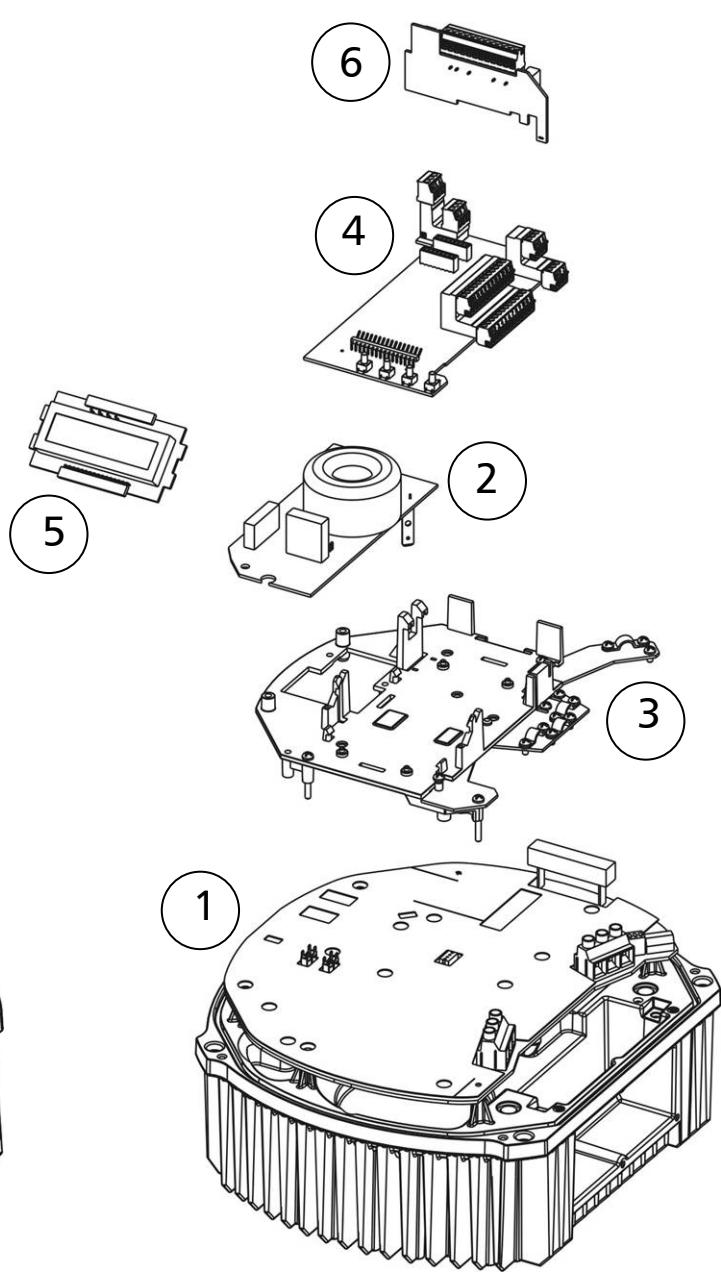
7 Modules

Regarding to your application the needed configuration which is available for the HYDROVAR can be selected. Due to this possibility the HYDROVAR can be configured regarding the reliability and cost effectiveness for your specific application.

HV 4.022 / 4.030 / 4.040



HV 4.055 / 4.075 / 4.110





Power unit

In its standard form it will be used as Basic Inverter or as simple soft starter in a single pump application!

When using a Master configuration the power unit is fitted with an additional control card! This is the basic part for all configurations and always used.

(1) Filter card

Optional filter card to ensure EMC regulations for domestic environments. (Class B)

Mounting Kit

The "Mounting Kit" consists of the metal and the plastic cover. On the plastic cover the control card is fixed, if used also the display and the additional Relay Card is there mounted. The pre-mounted cable-clips, which are necessary to connect the screen of all signal cables to HYDROVAR-ground, are placed on the metal cover.

(2) Control card

The control card is used for the Master/Single Inverter and includes the I/O's for the digital and analogue in and out signals the display unit and the push buttons.

(3) Display unit

Depending to the installation position (horizontal or vertical) the display can be turned to your preferred position!

(The push-button assignment will change automatically when turning the display!)

(4) Relay Card

The optional Relay Card allows to control up to 5 fixed speed pumps (can be only used in combination with the Master Inverter).

8 Mechanical components

8.1 Included mounting material

| Included components | Cable gland +lock nut | | | Closing gland | Motor PTC | Mounting clamps | centring - bit |
|---------------------|-----------------------|--------|------|---------------|-----------|-----------------|----------------|
| | M | M | M | M | M | | |
| | 12 | 16 | 20 | 25 | 12 | 16 | |
| Cable diameter [mm] | 3,5-7 | 4,5-10 | 7-13 | 9-17 | | | |
| 2.015- 2.022 | 2 (3) | 2 | 2 | | 3 | 1 | 1 |
| 4.022- 4.040 | 2 (3) | 2 | 2 | | 3 | 1 | 1 |
| 4.055- 4.110 | 2 (3) | 2 | | 2 | 3 | 1 | 1 |

() max. available cable entries

8.2 Optional components

8.2.1 Mounting accessories

Mounting ring

Available for diameters:

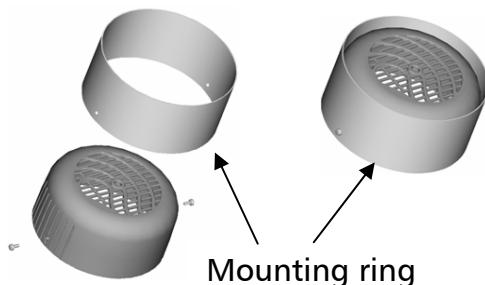
140 mm

155 mm



CAUTION!

If the HYDROVAR is mounted on a motor with plastic fan cover, a stainless-steel mounting ring must be used to support the weight of the motor.



Mounting ring

8.2.2 Sensors

- pressure-transducer
- differential-pressure-transducer
- level-sensor
- temperature-sensor
- flow indicator
(orifice plate, inductive flow meter)

8.2.3 Filter

- Line-coils

8.2.4 Ready-made Motor cables

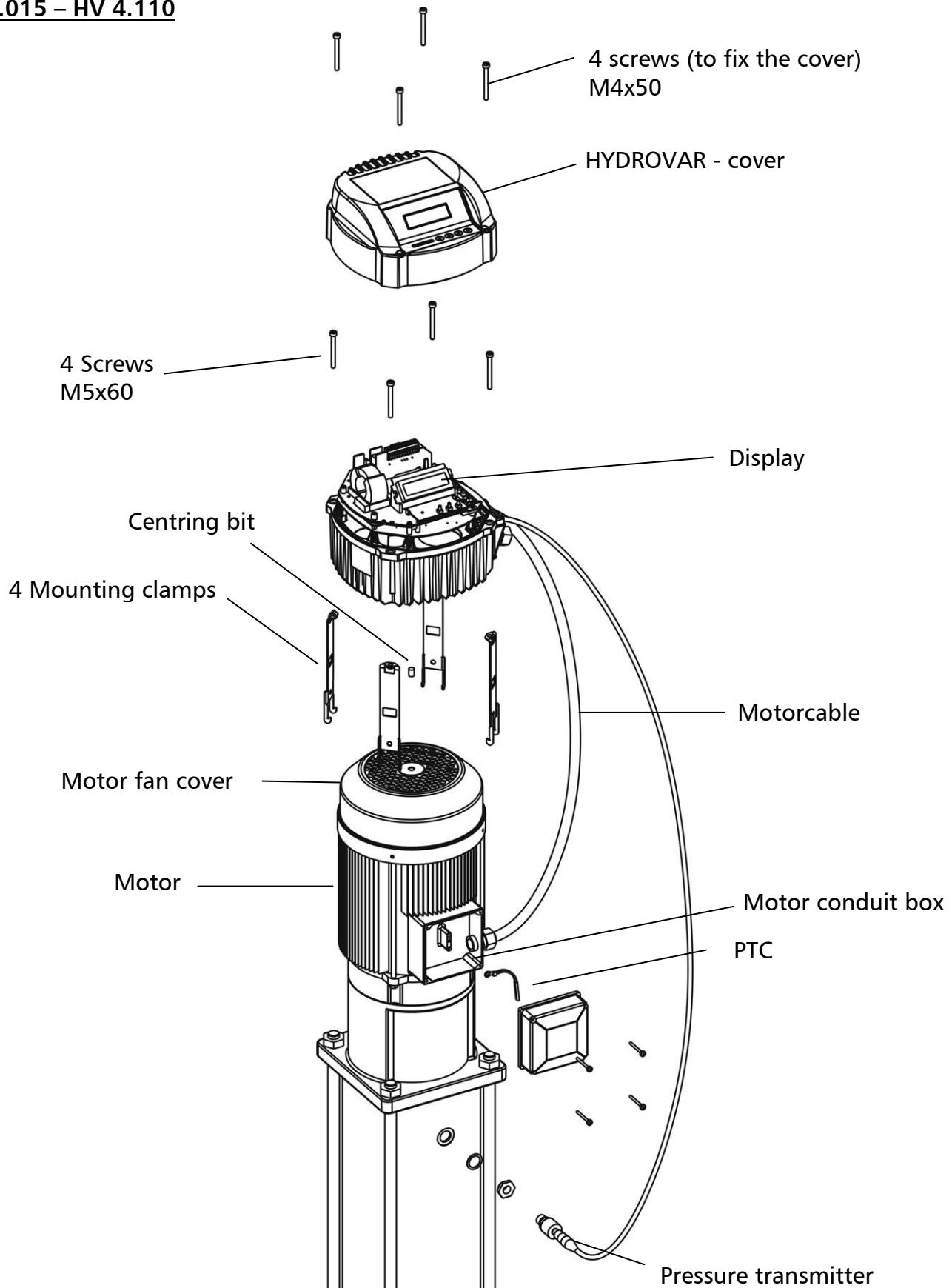
Available for HV 2.015 – 4.110



ITT

8.3 Assemble instruction

HV 2.015 – HV 4.110



To remove the HYDROVAR – cover, the 4 fastening screws must be opened.

- Ensure that there is no liquid on the unit before you open the cover.
- Centre the HYDROVAR on the motor fan cover using the rubber centre bit.
- If the HYDROVAR is mounted on a motor with plastic fan cover, a stainless steel mounting ring must be used.
- The HYDROVAR is installed on the motor fan cover by using the mounting brackets, the four screws and the related washers.
- The HYDROVAR has to be centred and then the four screws must be tightened.
- Tighten each fastening screw until the two bottom teeth in the brackets start to grip the fan cover.
- After the electrical components are connected, the top cover of the HYDROVAR can be mounted and tightened by the four fastening screws.
- Make sure of a good connection of the ground wire.
- Control the gasket of the HYDROVAR before tighten the fastening screws.
- Ensure that the mounting of the cable glands is done properly and use closing glands for cable-entries which aren't used.

9 Electrical installation and wiring



All installations and maintenance have to be performed by properly trained and qualified personnel with proper tools!!
Use personally protection equipment.



In case of a failure, the electrical power has to be disconnected or switched off. Wait at least 5 minutes for capacitor discharge before servicing the HYDROVAR.
Otherwise it can cause shock, burns or death.

9.1 Means of protection

Ask your power supply company which means of protection are required.

Applicable:

- protective earthing
- AC and DC residual current operated protective devices (RCD)
- TN systems

Protective earthing:

- Please note that a current to earth can occur due to the capacitors in the input filter.
- A suitable protection unit has to be selected (according local regulations).

Residual current device (RCD/RCCB):

- When using a RCD, make sure that it also releases in the event of a short circuit inside the DC-part of the HYDROVAR to earth!
 - single phase HYDROVAR => use pulse sensitive RCDs
 - three phase HYDROVAR => use AC/DC sensitive RCDs
- The RCD has to be installed according local regulations!

Automatic circuit breaker:

- Use automatic circuit breaker with C-type characteristic curve
- Rating of the line-protection (see chapter Technical Data)

Internal protective devices of the HYDROVAR:

- The malfunctions short circuit, under- and over-voltage, overload and the overheating of the electronic components are monitored internally by the HYDROVAR.

External protective devices:

- Additional protective functions like motor overheat and low water protection, are controlled by external equipment.



9.2 EMC-electromagnetic compatibility

To ensure the electromagnetic compatibility the following points must be observed for cable installation:

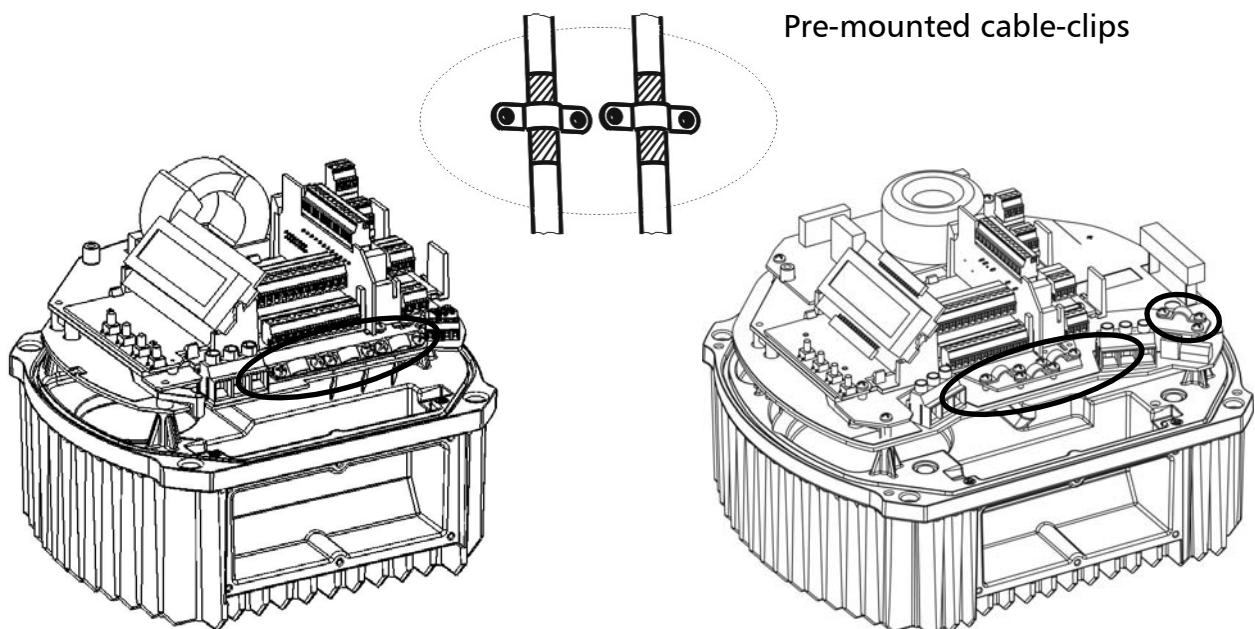
Earth / ground to ensure EMC

- **Protection earth**
It is important to connect the HYDROVAR to PE, because of the earth leakage current.
- **HF earth connection**
Ground cables should be as short as possible and with lowest impedance.

Signal cables

Control and signal cables should be screened types to prevent disturbances from outside.

The screen should be only connected to ground on one side; to prevent ground loops. The screen should be extensively connected with cable-clips to HYDROVAR GND (use pre mounted cable-clips).



To connect a screen with lowest impedance to ground, remove the isolation from the signal cable and connect the screen extensive to ground.

Signal cables must be installed separate from motor- and power-supply cables. If signal cables are installed in parallel to power supply cables (motor cables) for a longer distance, the distance between these cables should be more than 200mm. Don't cross power cables with control cables-if this is not possible, cross them only in an angle of 90°.

Motor cables

To ensure the EMC compatibility and minimize noise level and leakage currents, keep the motor cable as short as possible and use shielded cables only.

Additional component line choke (coil)

Line coils are available as an option and should be mounted between the HYDROVAR and the main fuse. The Line coil should be as near as possible to the HYDROVAR (max. 30cm).

Advantages:

- better efficiency
- reduction of harmonic currents

For the following applications additional line chokes are strongly recommended:

- high short circuit currents
- compensation-plants without a coil
- asynchronous motors which are responsible for a voltage drop >20% of the line voltage

EMC summary

- Install potential equalization according local regulations
- Don't install the power-cable in parallel to signal-cables
- Use screened signal-cables
- Connect both ends of the screen of the motor cable to ground
- Connect only one end of the screen of a signal-cable to ground
- Motor-cable as short as possible
- "Pigtails" should be prevented

9.3 Recommended Cable Types

To ensure the above mentioned points to guarantee EMC compatibility and a correct function of the HYDROVAR the mentioned cable types should be used.

| Application | Recommended cable-type |
|---|---|
| - Motor-cables HV 2.015-2.022 HV 4.022-4.040 HV 4.055-4.075 HV 4.110 | 4G1,5 + (2 x 0.75) FDF 4G1,5 + (2 x 0,75) FDF 4G2,5 + (2 x 0,75) FDF 4G 4 + (2 x 0,75) FDF |
| - Control- and signal- cables | JE-Y(ST)Y ... BD JE-LiYCY ... BD |
| - Cables connected to RS485 interface | JE-Y(ST)Y 2 x 2 x 0,8 BD |

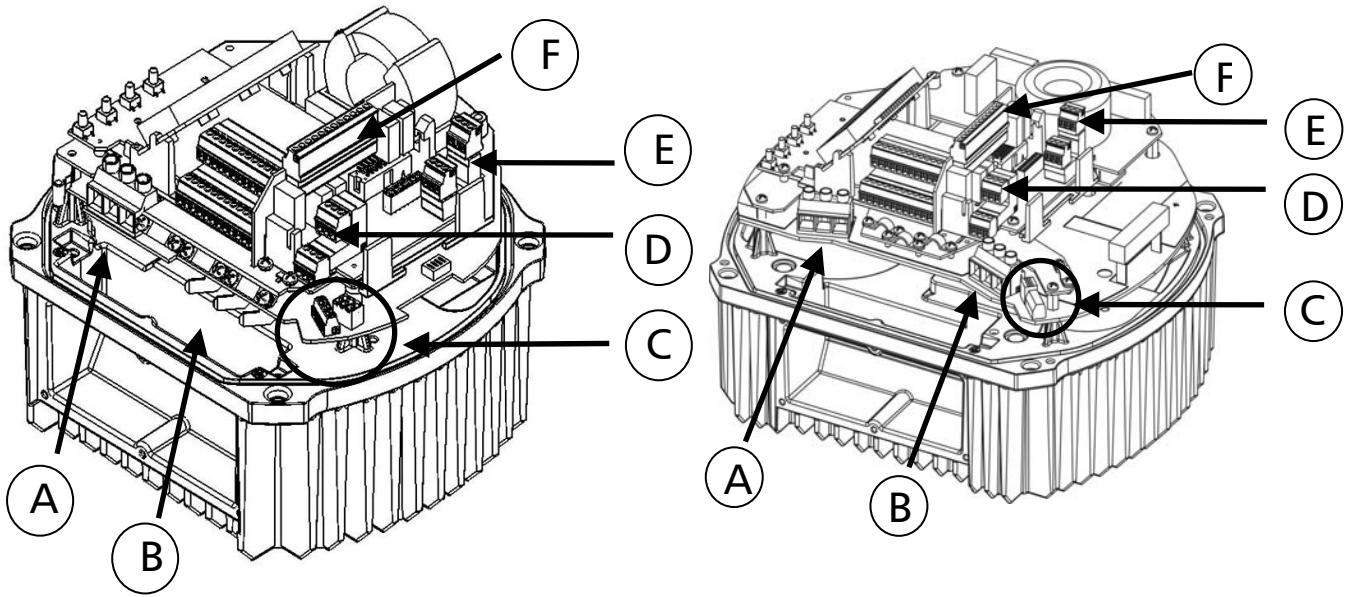
9.4 Wiring and connections

Remove the screws holding the top cover of the HYDROVAR.

Lift off the top cover. The following parts can be seen on a HYDROVAR Master / Single Inverter:

HV 2.015 / 2.022 HV 4.022 / 4.030 / 4.040

HV 4.055 / 4.075 / 4.110



(A) Power supply

(B) Motor connections

(C) Terminal block:
- START/STOP_PTC
- SOLORUN
- RS-485 Interface

(D) RS-485 Interface
- User interface
- Internal interface

(E) Status-Relays

(F) optional Relay Card

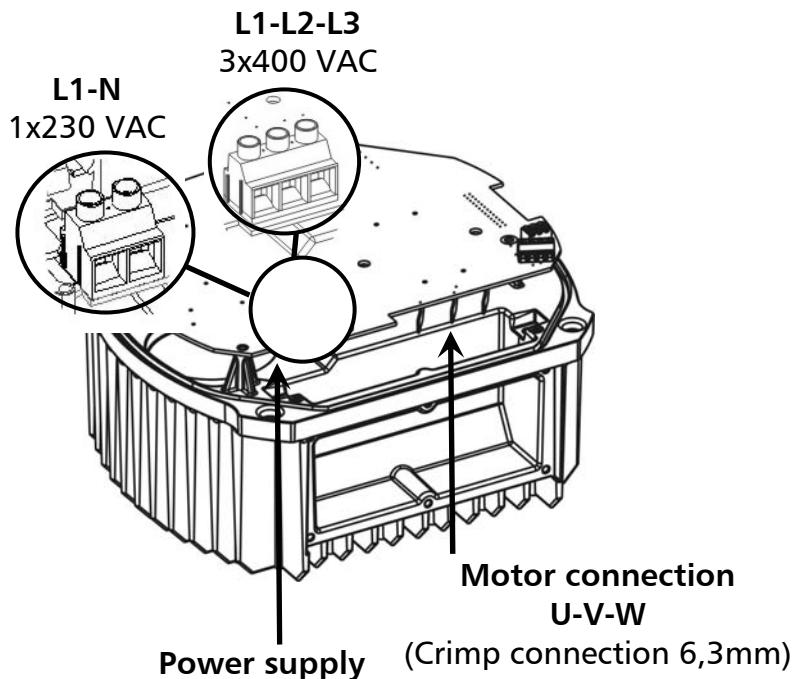


9.4.1 Main voltage terminals

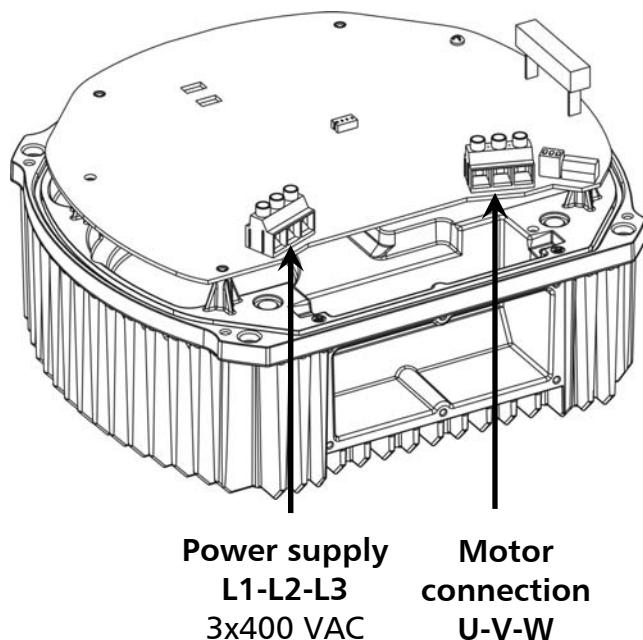
The power supply is connected to the power section:

Terminal L1 + N (1 x 230 VAC, single-phase)
Terminal L1 + L2 + L3 (3 x 400 VAC, three-phase)

HV 2.015 / 2.022 HV 4.022 / 4.030 / 4.040



HV 4.055 / 4.075 / 4.110

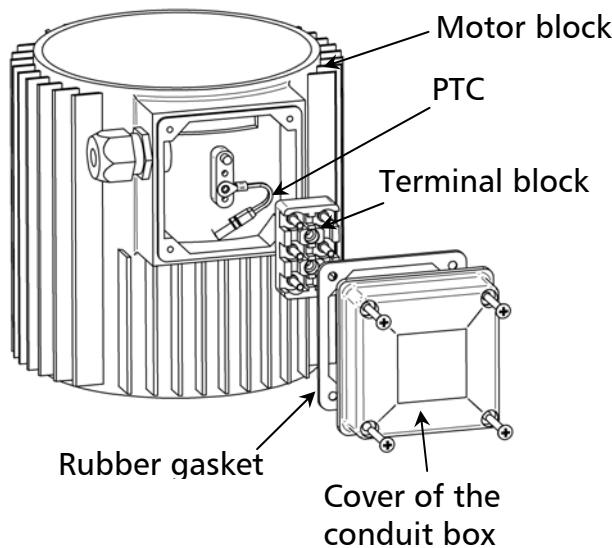




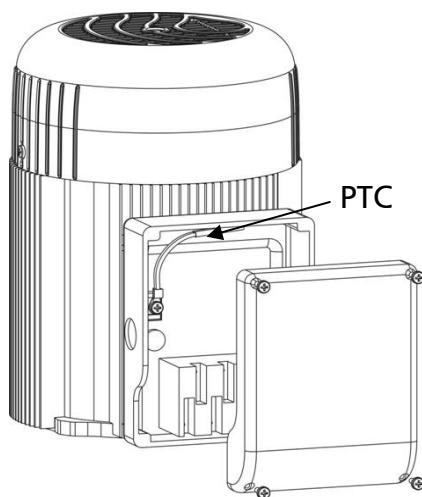
9.4.2 Motor connection

Mounting of the PTC

Variant A :



Variant B :

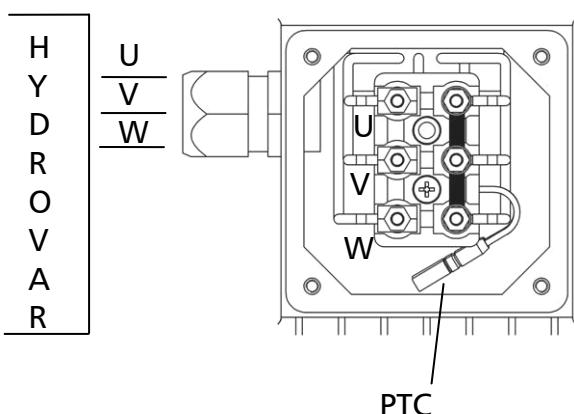
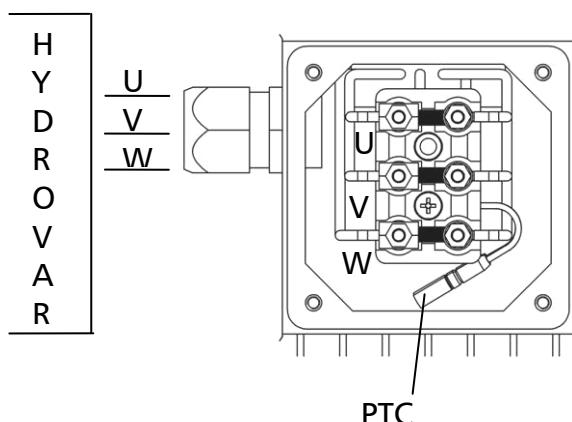


1. The cover of the conduit box must be opened and the terminal block inside removed
2. Fix the PTC (Variant A or B)
3. Remounting of the terminal block
4. Electrical connection of the motor cables

The PTC must be fixed to the metal compound of the motor. This is necessary to measure the right temperature of the motor!

The connection of the motor cable depends on the type of the motor and can be done in star- or delta connection.

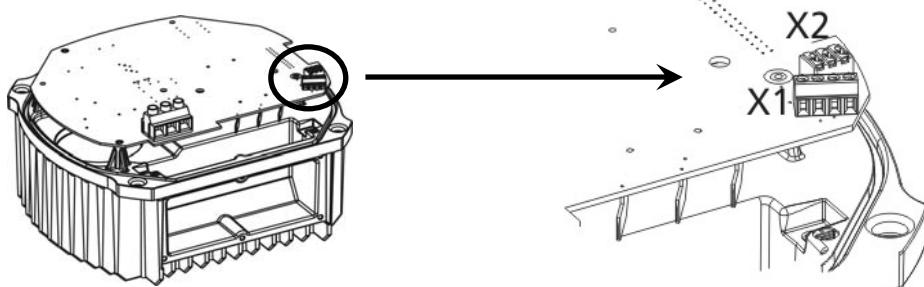
The right connection of the motor has to be selected as shown on the motor label according to the output voltage of the HYDROVAR.

star - connectiondelta - connection

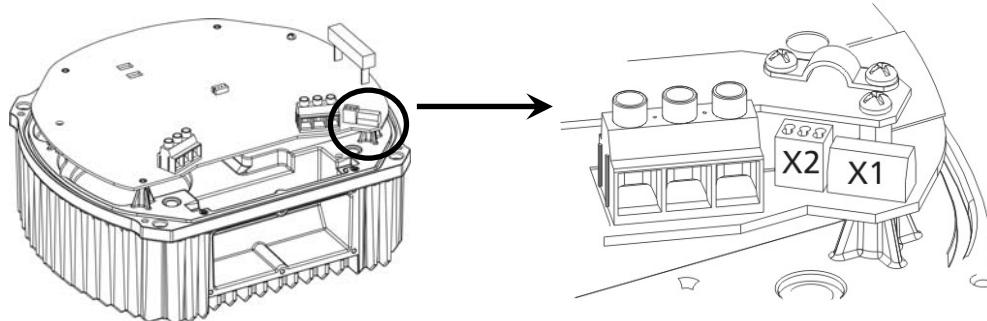
9.4.3 Power unit

On the power unit in its basic form, which is used as Basic Inverter in multi-pump systems or as a simple soft starter in a single pump application, is fitted with two control terminal-blocks.

HV 2.015/2.022 HV 4.022 / 4.030 / 4.040

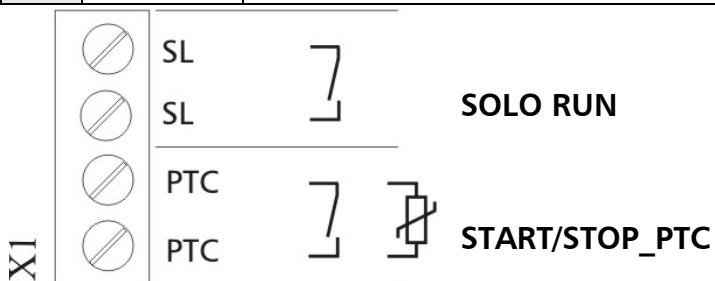


HV 4.055 / 4.075 / 4.110



X1 Control terminals – power unit

| | | |
|--|------------|--|
| | PTC | PTC or thermal switch START/STOP (external release) when using a Basic Inverter |
| | SL | SOLO RUN |



To ensure a safe operation between the HYDROVAR and the motor if the HYDROVAR is used as Basic Inverter, a motor-thermo-switch or PTC and an external on/off switch should be connected to the power unit. They must be connected to X1/PTC in serial and will stop the HYDROVAR in case of a failure! (Also a low-water switch or any other protective devices can be connected to these terminals!)

If there aren't connected any external protective devices or they are connected directly to the control card when using a Master Inverter, bridge terminals X1/PTC, otherwise the HYDROVAR can't be started.

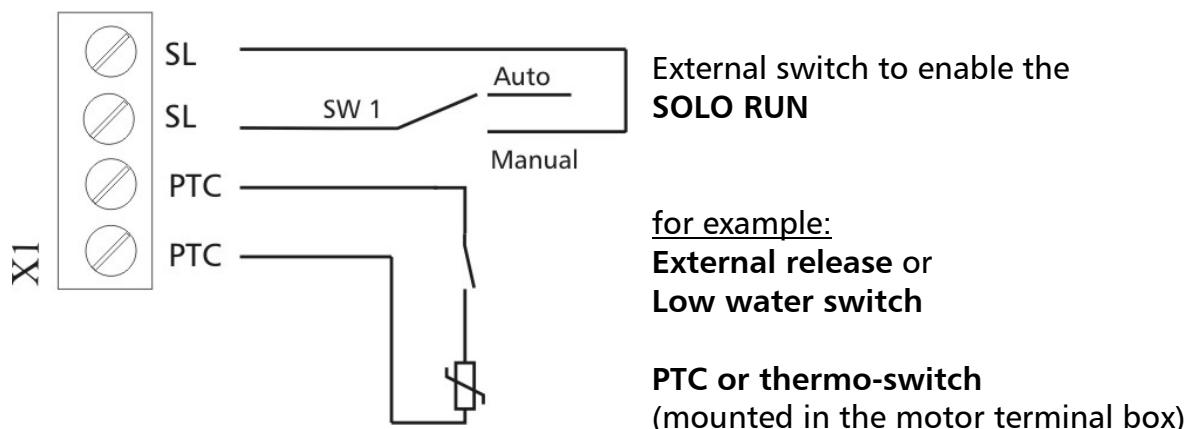
9.4.3.1 Solo run

The terminals X1/SL are used to release a Basic Inverter (when used in a multi-pump application) when the communication to the Master Inverter fails, or even the Master Inverter itself fails, or in case the Basic Inverter is just used as simple soft-starter.

- At opened contact X1/SL the HYDROVAR works in standard operation. So a Basic Inverter only starts up, if it is released and requested by a Master Inverter via the serial RS485-Interface.
- When contact X1/SL is closed the HYDROVAR starts up to pre-selected MAX. FREQUENCY [0245] using Ramp 1 and 2 and even the fast ramps FminA and FminD.
(X1/PTC must be closed too - all external connected safety devices are still active)

A manual start up is always possible, even the HYDROVAR is equipped with a control card. For example, if it is necessary because of safety reasons to operate the Basic Inverters when the Master Inverters fail, it is possible to equip this terminal with an AUTO/MANUAL switch.

Connection Example



Recommended connections of external protective devices:

| | | | |
|------------------------|-----------------------|--------|--------------------------|
| Basic Inverter: | PTC or thermal switch | X1/PTC | Placed on the power unit |
| | External release | X1/PTC | |
| | Low water switch | X1/PTC | |

| | | | |
|-------------------------|-----------------------|----------|----------------------------|
| Master Inverter: | PTC or thermal switch | X1/PTC | Placed on the power unit |
| | External release | X3/7-8 | Placed on the control card |
| | Low water switch | X3/11-12 | |



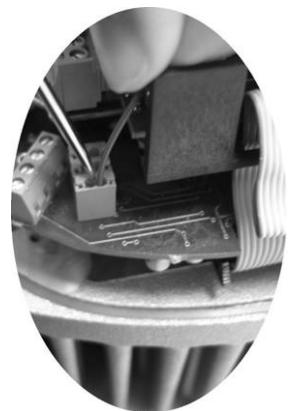
If the HYDROVAR is used as Basic Inverter in a multi-pump system, the internal interface on the power unit is used for the serial RS-485 connection to the other HYDROVARs in the system. (Be careful: Internal interface is not active for Single Inverter configuration!)

| X2 RS485-Interface – Power Unit | | |
|---------------------------------|-------|------------------------------|
| X2/ | SIO - | Internal SIO-interface: SIO- |
| | SIO + | Internal SIO-interface: SIO+ |
| | GND | GND, electronic ground |



..... Parameter not available for a HYDROVAR Single Inverter

The **internal RS-485 Interface** on the power unit is used for the communication between up to 8 HYDROVARs in a multi-pump system (minimum 1 Master Inverter). For the connection to each HYDROVAR via the RS-485 interface the terminals X2/1-3 on the power unit can be used twice. Even the terminals X4/4-6 on the control card, can be used.

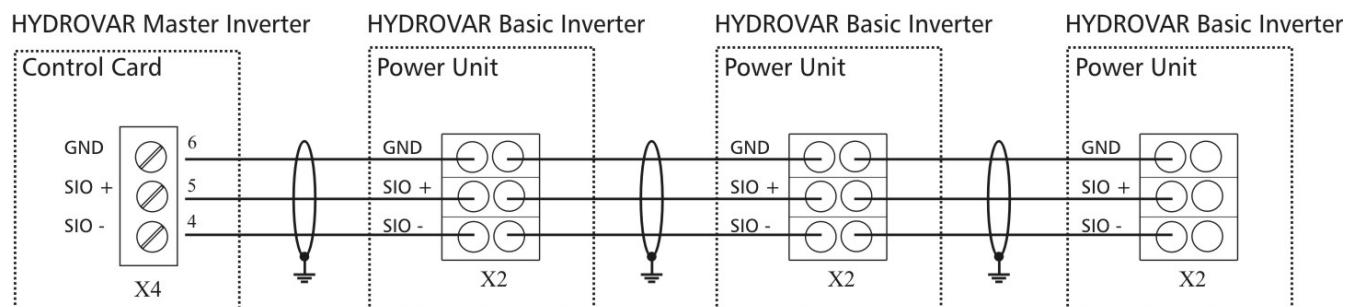


Mechanical connection of the terminal:

- Use recommended cable type (see chapter 9.3)
- Strip the end of the used wire (about 5 ... 6mm)
- push down the orange wedges by using a small screwdriver
- insert the stripped wire
- remove the screwdriver to fix the wire

- To remove, push down the orange wedges and pull out the wire!

Connection example using one Master- and three Basic - Inverters:



9.4.3.2 Addressing

When using the cascade serial mode in a multi-pump-application where more than one Master Inverters, or additional to Master Inverters also Basic Inverters are used, the right address must be set to guarantee the correct function of this system.

Master Inverter – The desired addresses of the Master Inverter have to be set via the HYDROVAR-Software. In this case for all Master Inverters the below shown Dip-Switch on the power unit must be set to address 1 (default setting).

Basic Inverter – When using a Basic Inverter in a Multi-pump-system it is necessary to set the Dip-Switches on the power unit in order to get a separate address for each Inverter within your pump group. (pls. consider reserved addresses for the Master Inverters)

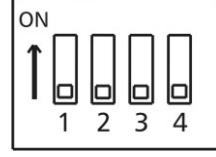
for example:

Multi-pump-system with 3 Master and 4 Basic Inverters

- Set address 1-3 for the Master Inverters via appropriate software parameters (see submenu RS485-INTERFACE [1200])
- Address 4-7 for the Basic Inverters via Dip-Switch

The pre-selected address is also responsible for the pump sequence.

| Switch 1 | Switch 2 | Switch 3 | Address |
|----------|----------|----------|---|
| OFF | OFF | OFF | Address 1 (default setting) (Required setting for the use with control card) |
| OFF | OFF | ON | Address 2 |
| OFF | ON | OFF | Address 3 |
| OFF | ON | ON | Address 4 |
| ON | OFF | OFF | Address 5 |
| ON | OFF | ON | Address 6 |
| ON | ON | OFF | Address 7 |
| ON | ON | ON | Address 8 |



Switch 4 is not used!

Setting of the correct address:

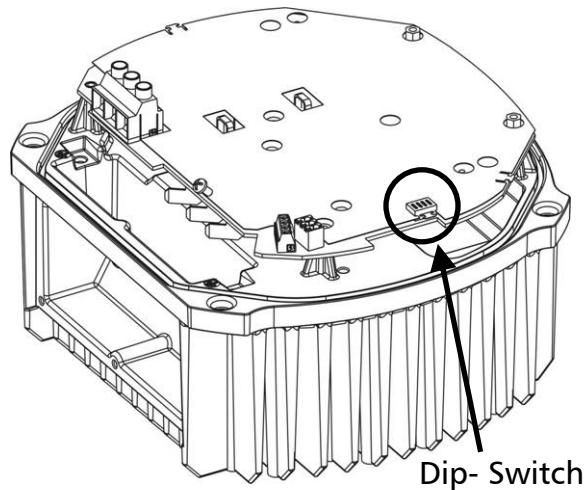
- **The HYDROVAR must be disconnected from power supply at least for 5 minutes before removing the top-cover (open four fastening screws)!**
- Find the Dip-switch which is placed on the power unit (see picture next page!)
- Set the desired address for each Inverter
e.g. Address 4 -> Switch 1 is set to OFF
 Switch 2 and 3 are set to ON
- Mount the cover on the HYDROVAR and tighten the four fastening screws
- Reconnect HYDROVAR to power supply



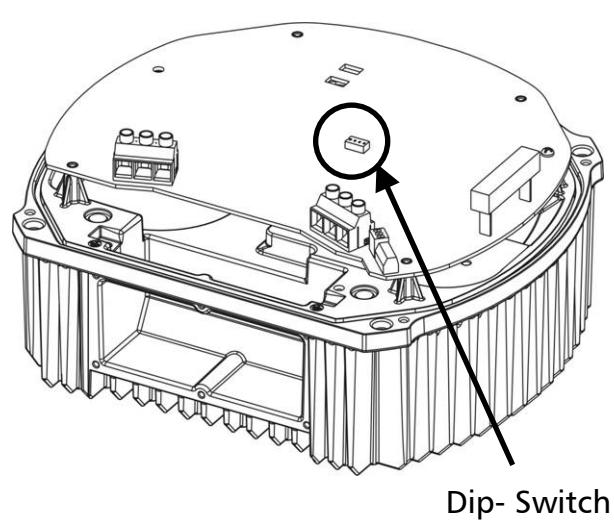
ITT

HV 4.022 / 4.030 / 4.040

Basic Inverter



Basic Inverter



9.4.4 Control unit

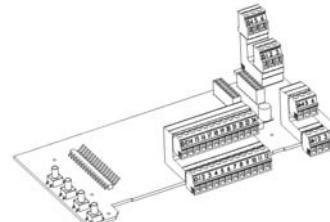
Regarding the hardware configuration of your HYDROVAR there are two different control cards available.

The control unit of the **HYDROVAR Master Inverter** basically consists of the control card and the additional boards which are connected to the control card via slot connectors. This configuration is able to support all special software features and optional boards.

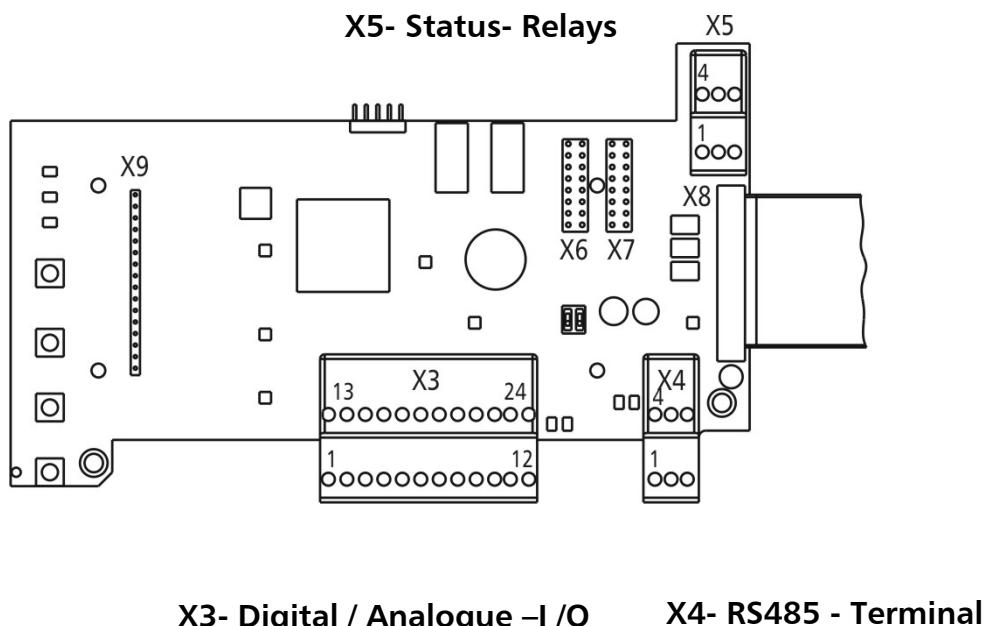
The second available control card included in the HYDROVAR Single Inverter is developed just for single pump operation. This control card doesn't support any additional boards and includes just the minimum necessary software parameters.

9.4.4.1 Control card – HYDROVAR Master Inverter

The control card is connected to the power unit via a ribbon cable on terminal **X8**.



- The display is connected to terminal **X9**
The display can be mounted in normal position (0°) or upside down (180°).
- The connection terminals **X6** and **X7** can be used if optional boards are available.
e.g. the additional Relay Card can be connected to the control card at connection slot **X6**.





Control terminals

All control cables connected to the control-unit have to be screened (See chapter 9.3 recommended cable types).



NOTE:

If unscreened control cables are used, signal interference may occur and could interfere with the incoming signals and the function of the HYDROVAR.

Don't connect the ground of the control card to other voltage potentials.

All electronic ground terminals and GND of the RS 485-interface are connected internally.

| X3 Digital and Analogue I/O | | | |
|-----------------------------|--|----------|--|
| X3/ | 1 GND, electronic ground 2 Actual value current input sensor 1 3 Power supply for external sensors 4 Actual value current input sensor 2 5 Actual value voltage input sensor 2 6 Actual value voltage input sensor 1 7 External ON/OFF (release) 8 GND, electronic ground 9 Configurable digital input 1 10 GND, electronic ground 11 Low water 12 GND, electronic ground | | 0-20mA / 4-20mA [Ri=50Ω] 24VDC, ** max. 100mA 0-20mA / 4-20mA [Ri=50Ω] 0-10 VDC 0-10 VDC Active low Active low Active low |
| | 13 Voltage signal input (required value 1) 14 GND, electronic ground | (Offset) | 0-10VDC |
| | 15 Voltage signal input (required value 2) 16 GND, electronic ground | *Dig 4 | 0-10VDC |
| | 17 GND, electronic ground 18 Current signal input (required value 1) 19 +10V internal ref. for analogue output 20 Analogue output 1 21 Analogue output 2 22 GND, electronic ground 23 Current signal input (required value 2) 24 +24V power supply for control inputs | (Offset) | 0-20mA / 4-20mA [Ri=50Ω] 10,00VDC, max. 3mA 0-10VDC, max. 2mA 4-20mA 0-20mA / 4-20mA [Ri=50Ω] 24VDC, ** max. 100mA |

* Terminals 5 and 6 can be used as actual value voltage input and also as digital input.

Also the voltage signal input on terminal X3/15 can be used as digital input.

** X3/3 and X3/24 → Σ max. 100mA

(Offset) These terminals can be used as required value or offset signal input.
Configuration: see submenu REQUIRED VALUES [0800] and submenu OFFSET [0900].

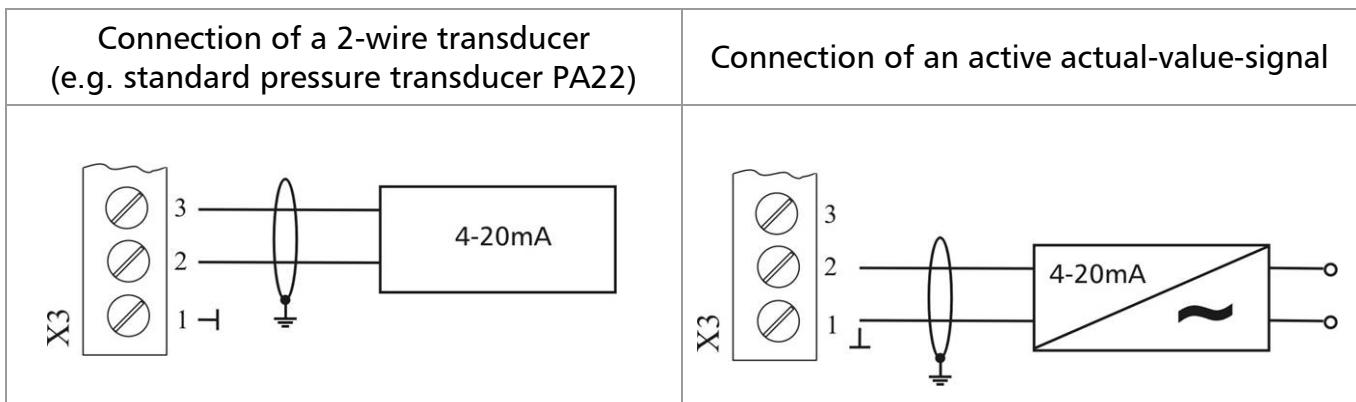
| | | | |
|----|----|------|---|
| X3 | 24 | +24V | Additional power supply ** max. 100 mA |
| | 23 | | Current signal input (required val. 2) 0-20mA / 4-20mA [Ri=50Ω] To determine the required value or the offset |
| | 22 | — | |
| | 21 | | Analogue output 2 4-20mA |
| | 20 | | Analogue output 1 0-10 VDC |
| | 19 | +10V | |
| | 18 | | Current signal input (required val. 1) 0-20mA / 4-20mA [Ri=50Ω] |
| | 17 | — | To determine the required value or the offset |
| | 16 | — | Voltage signal input (required value 2) 0-10 VDC *DIG 4 |
| | 15 | | To determine the required value or the offset |
| | 14 | — | Voltage signal input (required value 1) 0-10 VDC |
| | 13 | | To determine the required value or the offset |
| | 12 | — | Low water e.g. incoming pressure switch or water level switch |
| | 11 | — | |
| | 10 | — | Configurable digital input 1 DIG 1 e.g. for switching between 2 required values or sensors |
| | 9 | — | |
| | 8 | — | External ON/OFF (release) |
| | 7 | — | |
| | 6 | | Actual-value-voltage input sensor 1 0-10 VDC *DIG 2 |
| | 5 | | Actual-value-voltage input sensor 2 0-10 VDC *DIG 3 |
| | 4 | | Actual-value-current input sensor 2 0-20mA / 4-20mA [Ri=50Ω] |
| | 3 | +24V | Sensor supply ** max. 100 mA |
| | 2 | | Actual-value-current input sensor 1 0-20mA / 4-20mA [Ri=50Ω] |
| | 1 | — | Ground |

* Terminals X3/5 and 6 can be used as actual value voltage input and also as digital input. Also the voltage signal input on terminal X3/15 can be used as digital input.

** Voltage signal input on terminals X3/3 and X3/24 → Σ max. 100mA

**Connection examples:**

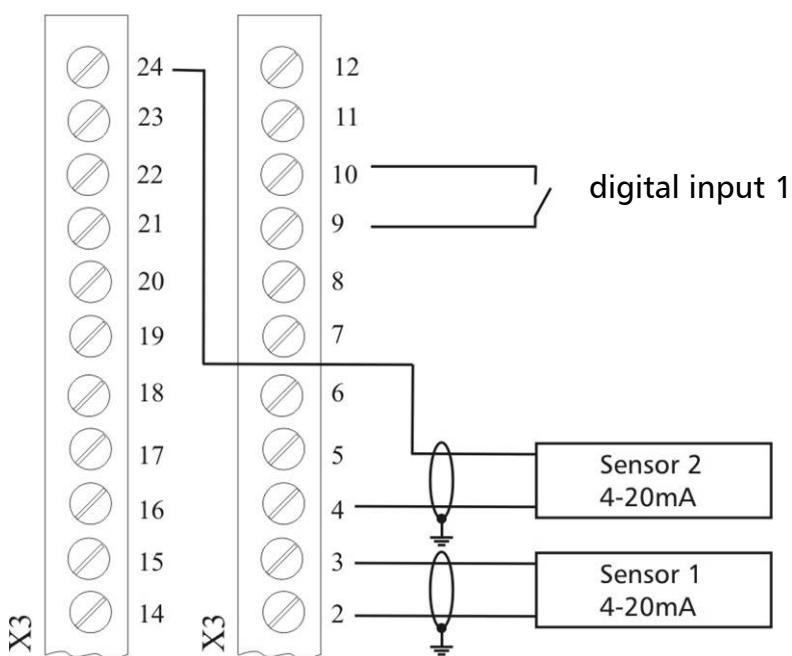
- Sensor–Actual-value-signal Input



| <u>Possible connections:</u> | <u>Standard pressure transducer PA22:</u> |
|------------------------------------|---|
| Actual-value-signal input 0/4-20mA | X3/4 ... Sensor 2 |
| +24VDC sensor supply | X3/3 brown |
| Actual-value-signal input 0/4-20mA | X3/2 ... Sensor 1 white |
| Ground | X3/1 |

- **Switching between two connected sensors**

External switching between two connected sensors by closing digital input 1 (X3/9-10). How to program see SUBMENU SENSORS [0400].

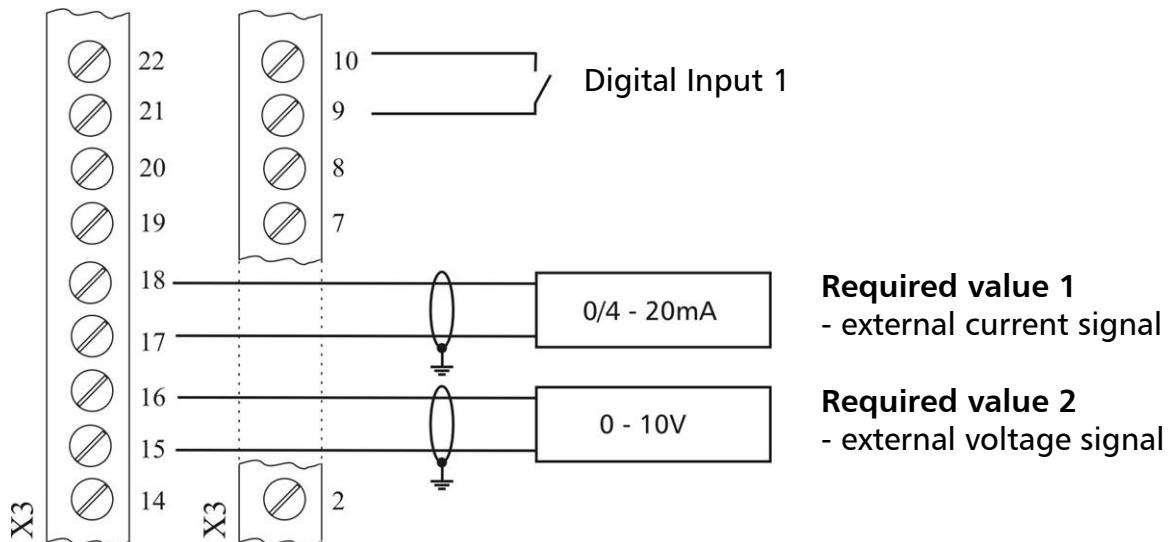


- **Switching between two different required values**

External switching between two connected required value signals (e.g.: between voltage and current signal input) by closing digital input 1 (X3/9-10).

In ACTUATOR mode it is possible to switch between two different frequencies by the digital inputs. The connected input signals (current or voltage) are proportional to the frequency.

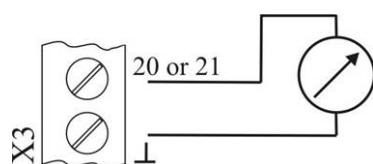
How to program see SUBMENU REQUIRED VALUES [0800].



- **Actual value – frequency indicator**

e.g. to display the actual motor frequency

How to program see SUBMENU OUTPUTS [0700].



Possible connections:

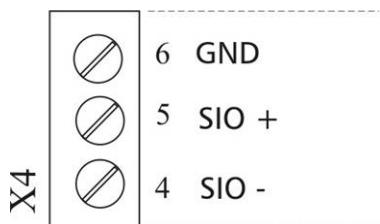
Analogue output 1 (0-10V): X3/20

Analogue output 2 (4-20mA): X3/21

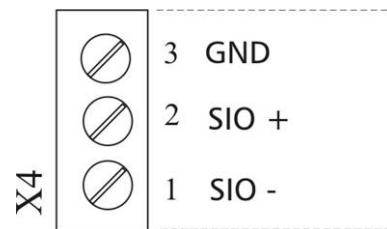


| X4 RS485-Interface | | |
|--------------------|---|------------------------------|
| X4/ | 1 | User SIO-Interface: SIO- |
| | 2 | User SIO-Interface: SIO+ |
| | 3 | GND, electronic ground |
| | 4 | Internal SIO-Interface: SIO- |
| | 5 | Internal SIO-Interface: SIO+ |
| | 6 | GND, electronic ground |

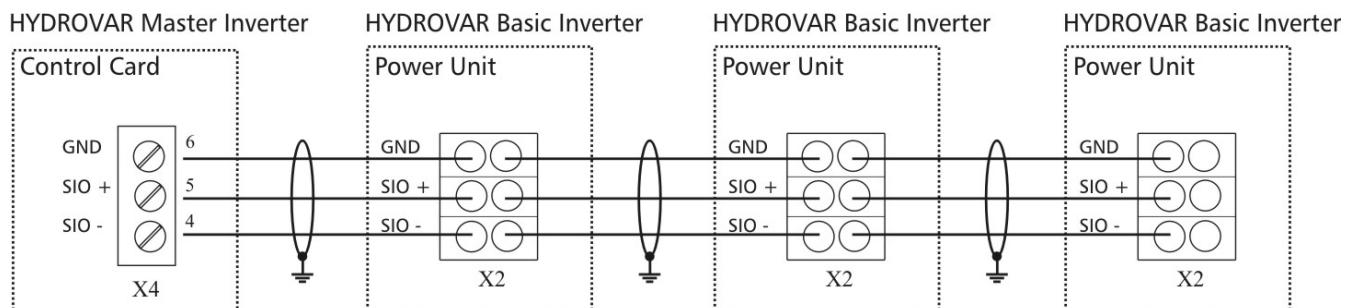
RS-485 – Internal interface



RS-485 - User interface

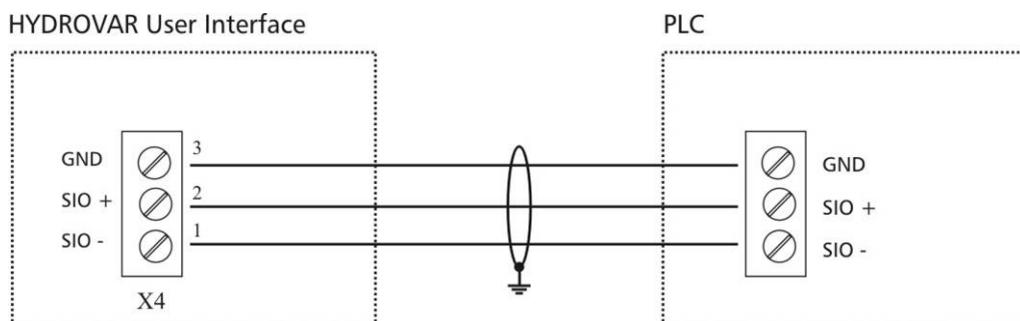


The **internal RS-485 Interface** is used for the communication between up to 8 HYDROVARs in a multi-pump application. For the connection of each HYDROVAR via the RS-485 interface the terminals X4/4-6 on the control card, and either the terminals X2/1-3 on the power unit can be used. ([Connection example:](#) using one Master- and three Basic-Inverters)



By using the **RS-485 – User interface** on the control card, one or more HYDROVAR can communicate via the standardized Modbus-protocol with an external-control-device (e.g. PLC). This interface can be used for parameterization and controlling the HYDROVAR via external devices. **Also active for HYDROVAR Single Inverter - Configuration.**

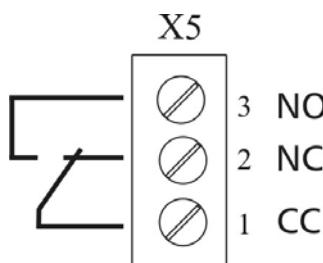
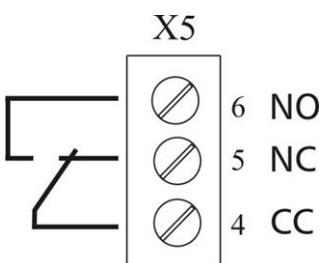
Do not use the internal interface as user interface and vice versa!





X5 Status-Relays

| | | | | | | |
|-----|---|----------------|----|--|---------------|---------|
| X5/ | 1 | Status Relay 1 | CC | | [Max. 250VAC] | [0,25A] |
| | 2 | | NC | | [Max. 220VDC] | [0,25A] |
| | 3 | | NO | | [Max. 30VDC] | [2A] |
| | 4 | Status Relay 2 | CC | | | |
| | 5 | | NC | | | |
| | 6 | | NO | | | |

Status Relay 1**Status Relay 2****Notice:**

When using the relay contacts for driving an external relay, a corresponding RC-snubber-circuit or varistor is necessary, to prevent disturbance of the HYDROVAR!

Both Status-Relays on the control card can be used regarding the programmed configuration.

Factory setting: The two relays are used as pump-running or fault-signal-relay. For this application see connection example below (How to program see parameters CONF REL 1 [0715] and CONF REL 2 [0720]).

Connection examples:

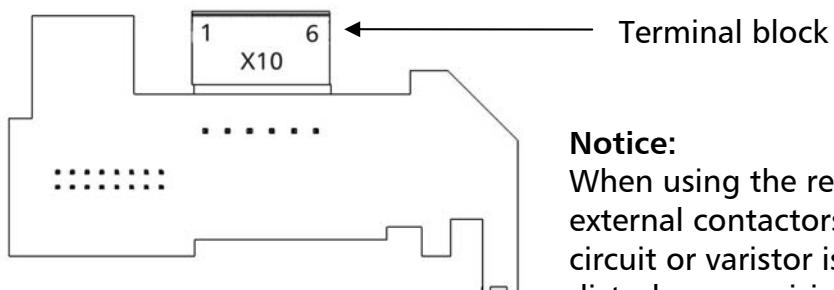
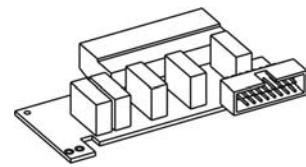
| Pump running signal | Fault signal |
|--|---|
| <p>Ext. 250VAC / 220VDC</p> | <p>Ext. 250VAC / 220VDC</p> |
| <p><u>X5/ 1 and 3 closed:</u> - motor run indication</p> | <p><u>X5/ 4 and 6 closed:</u> - if there is a fault/error</p> |



9.4.4.2 Relay Card

This optional component can be used only in combination with a HYDROVAR Master Inverter.

The Relay Card is connected to the control card using connection slot X6 (See chapter 9.4.4.1).

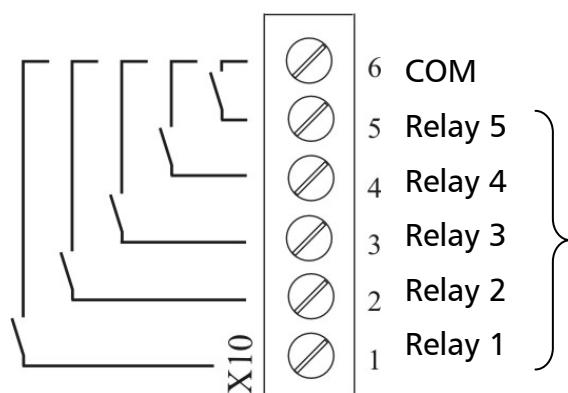


Notice:

When using the relay contacts for switching external contactors, a corresponding RC-snubber-circuit or varistor is necessary, to prevent disturbances arising during a switching action of the relay!

Terminals Relay Card

| X10 Relay Card | | | |
|----------------|---|---------|-----------------------|
| X10/ | 1 | Relay 1 | |
| | 2 | Relay 2 | [max. 250VAC] [0,25A] |
| | 3 | Relay 3 | [max. 220VDC] [0,25A] |
| | 4 | Relay 4 | [max. 30VDC] [0,25A] |
| | 5 | Relay 5 | |
| | 6 | COMMON | |



Contacts for switching the fixed speed pumps.

Please consider that the fixed speed pumps can't be switched directly by the Relay card (an external panel for the contactors of the D.O.L or STAR/DELTA starters is necessary).



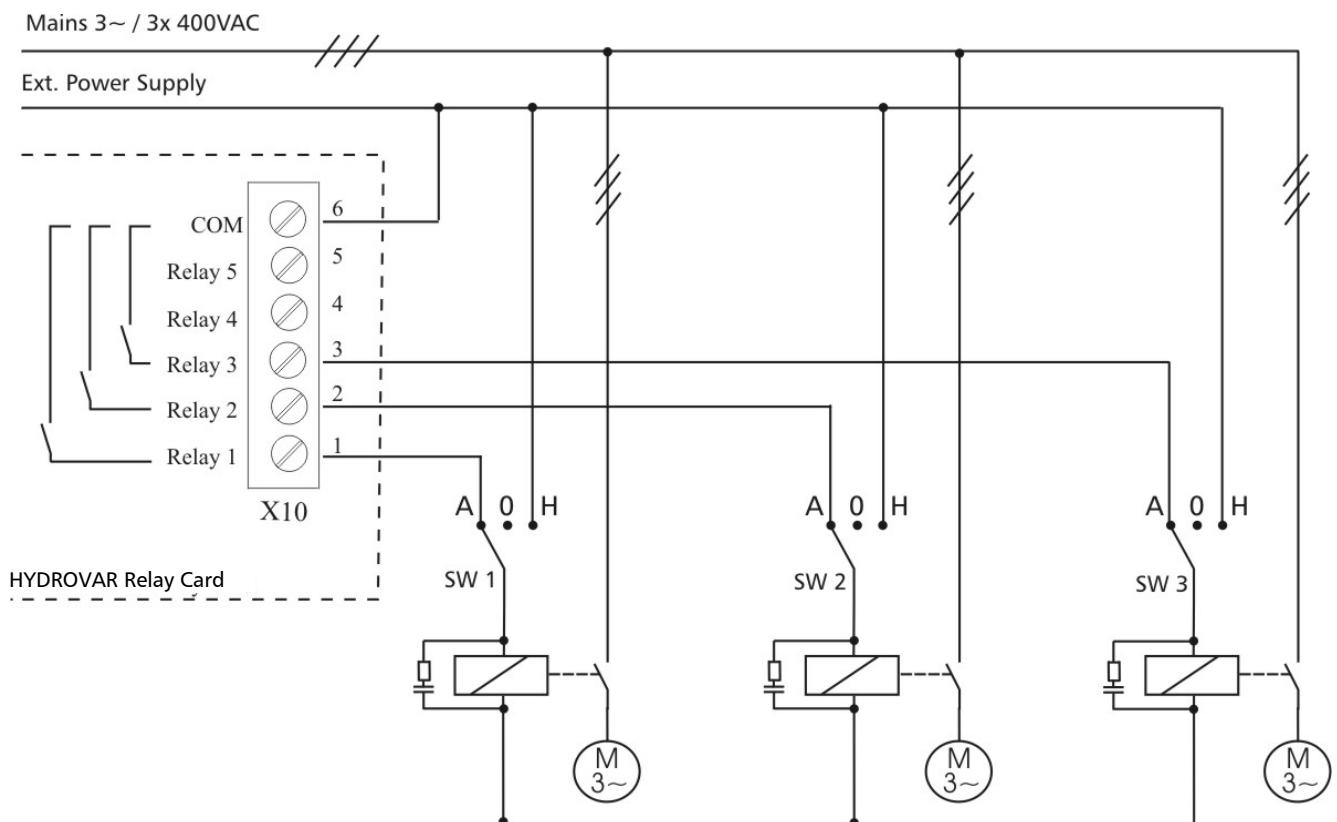
Connection example:

The following wiring diagram shows a standard cascade control system where the HYDROVAR is fitted with an additional Relay Card, in selected mode "Cascade Relay".

To switch the fixed speed pumps via the internal Relay Card, an external panel for the contactors of the D.O.L or STAR/DELTA starters (and optional A/O/M – switch) is required.

In the example below 3 fixed speed pumps are connected to the Relay Card. For such an application, an optional HAND/OFF/AUTO switch (SW1, SW2, and SW3) is recommended.

- During normal operation the switch is set to AUTO, so the Relay Card of the HYDROVAR starts and stops the connected pumps.
- The "HAND" position allows a manual operation of the pumps.
- If one of the additional switches is in OFF position, the related relay must be disabled in the submenu STATUS [20] to ensure correct operation of the multi-pump system.

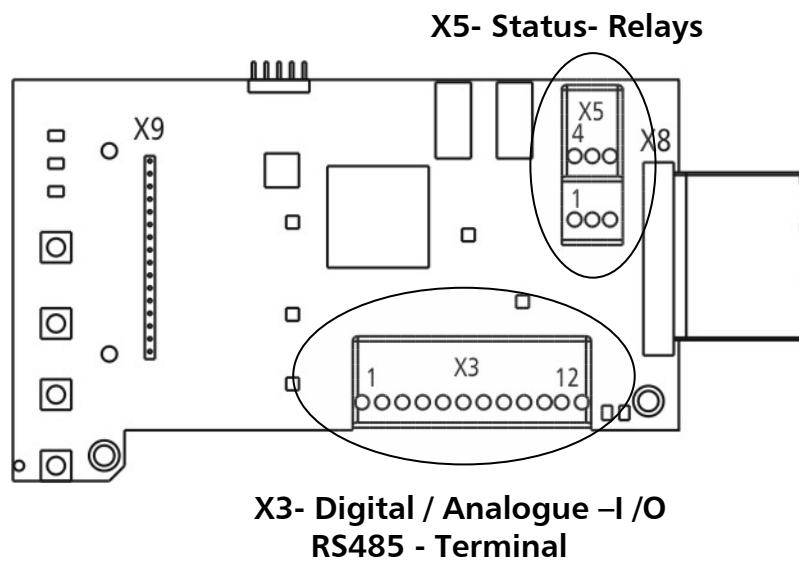


9.4.4.3 Control card – HYDROVAR Single Inverter

The control card is connected to the power unit via a ribbon cable on terminal **X8**.

The display is connected to terminal **X9**

The display can be mounted in normal position (0°) or upside down (180°).



Control Terminals

All control cables connected to the control-unit have to be screened (See chapter 9.3 recommended cable types).



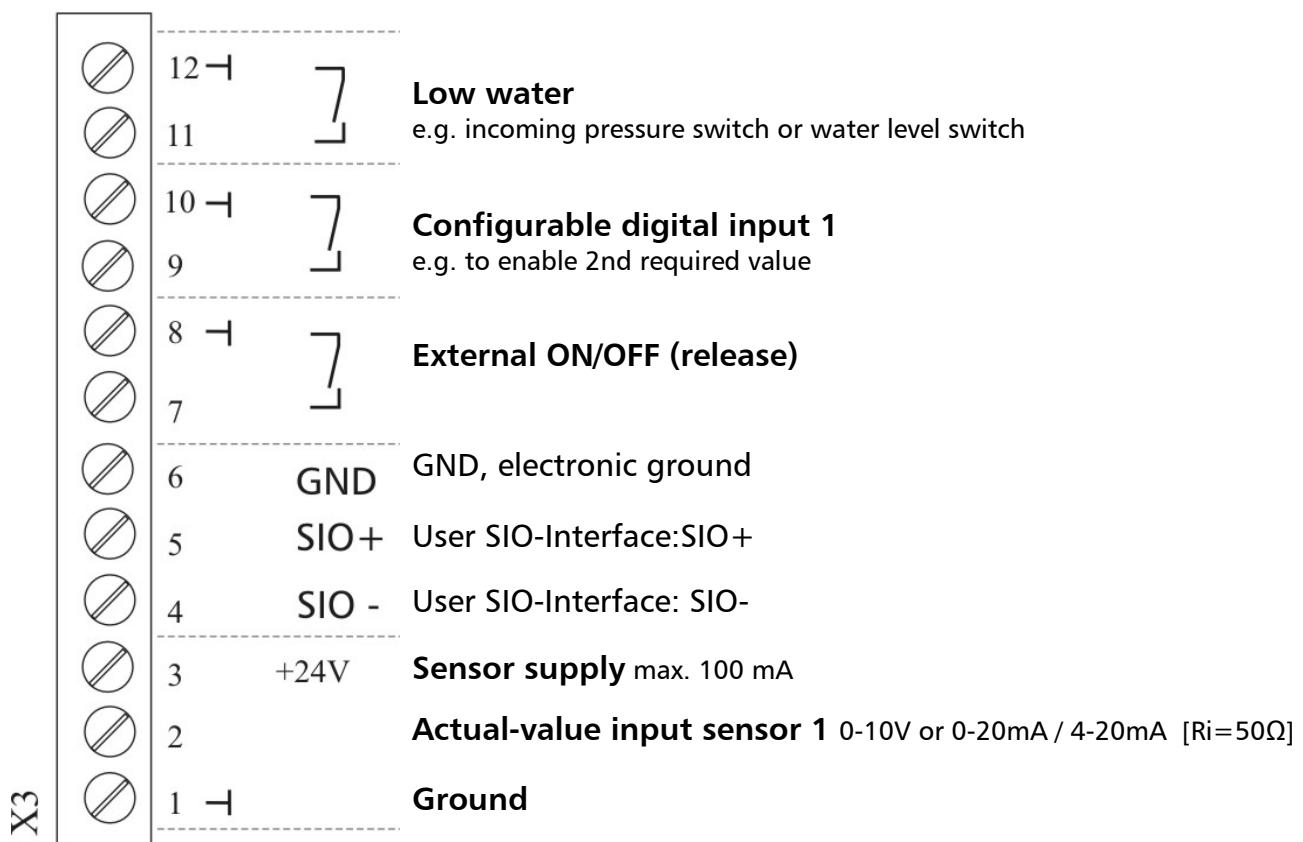
NOTE:

If unscreened control cables are used, signal interference may occur and could interfere the incoming signals and the function of the HYDROVAR.

Don't connect the ground of the control card to other voltage potentials.

All electronic ground terminals and GND of the RS 485-interface are connected internally.

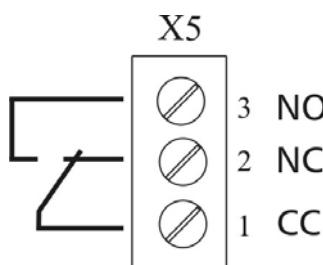
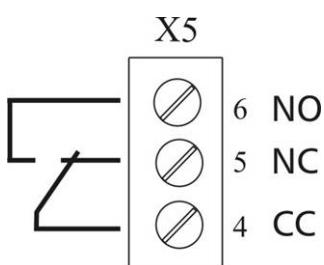
| X3 Digital and Analogue I/O | | |
|-----------------------------|--|--|
| X3/ | 1 GND, electronic ground 2 Actual value input sensor 1 3 Power supply for external sensors | 0-10VDC or 0-20mA / 4-20mA [Ri=50Ω] 24VDC, max. 100mA |
| | 4 User SIO-Interface: SIO- 5 User SIO-Interface: SIO+ 6 GND, electronic ground | } User Interface for external usage |
| | 7 External ON/OFF (release) 8 GND, electronic ground | active low |
| | 9 Configurable digital input 1 10 GND, electronic ground | active low |
| | 11 Low water 12 GND, electronic ground | active low |





X5 Status-Relays

| | | | | | | |
|-----|---|----------------|----|--|---------------|---------|
| X5/ | 1 | Status Relay 1 | CC | | [Max. 250VAC] | [0,25A] |
| | 2 | | NC | | [Max. 220VDC] | [0,25A] |
| | 3 | | NO | | [Max. 30VDC] | [2A] |
| | 4 | Status Relay 2 | CC | | | |
| | 5 | | NC | | | |
| | 6 | | NO | | | |

Status Relay 1**Status Relay 2****Notice:**

When using the relay contacts for driving an external relay, a corresponding RC-snubber-circuit is or varistor recommended, to prevent disturbances arising during a switching action of the relay!

Both Status-Relays on the control card can be used regarding the programmed configuration.

Factory setting: The two relays are used as pump-running or fault-signal-relay. For this application see connection example below (How to program see parameters CONF REL 1 [0715] and CONF REL 2 [0720]).

Connection examples:

| Pump running signal | Fault signal |
|--|---|
| <p>Ext. 250VAC / 220VDC</p> | <p>Ext. 250VAC / 220VDC</p> |
| <p><u>X5/ 1 and 3 closed:</u> - motor run indication</p> | <p><u>X5/ 4 and 5 closed:</u> - if there is a fault/error</p> |

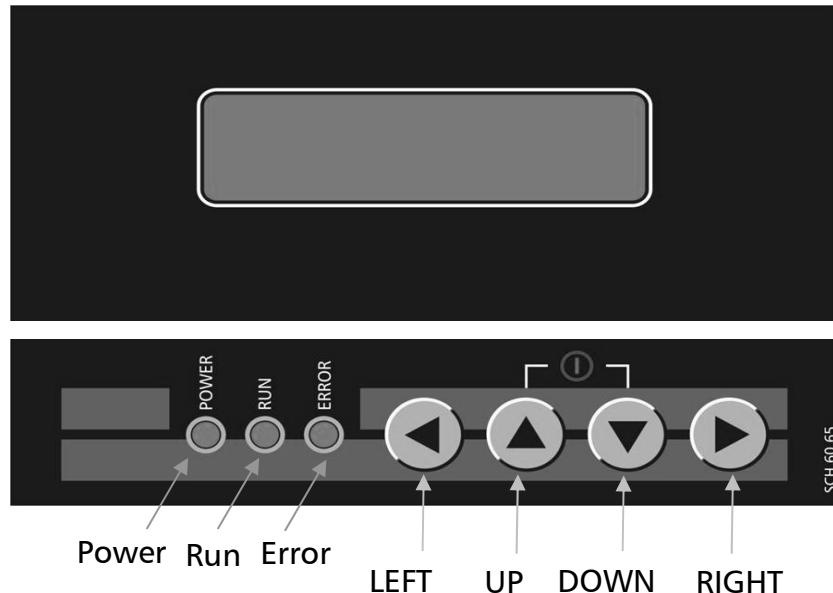


10 Programming



Read and follow the operating instructions carefully before start programming to prevent incorrect settings which will cause malfunction! All modifications must be done by qualified technicians!

10.1 Display – Control panel of the Master / Single Inverter



10.2 Function of the push buttons

- ▲ Start of the HYDROVAR in the 1st Window
- ▼ Stop of the HYDROVAR in the 1st Window

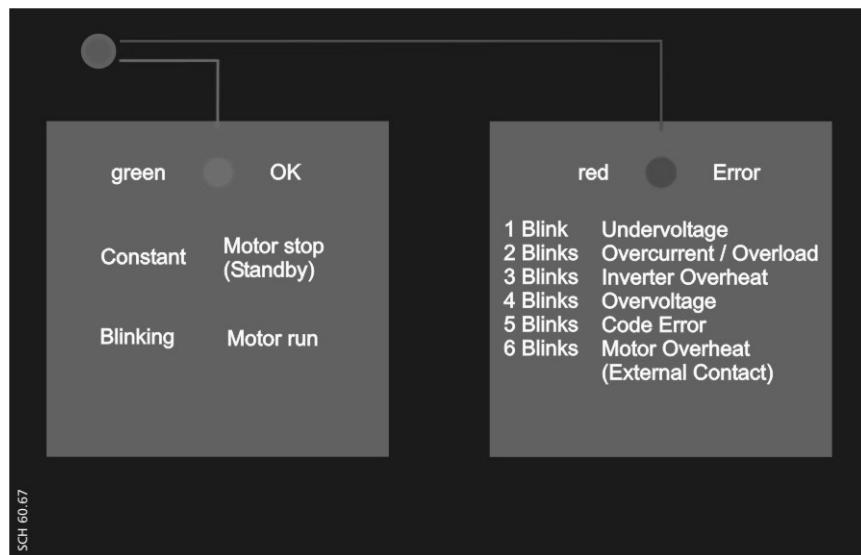
- ◀ and ▶ Reset: by pressing of both buttons simultaneously for 5 seconds

- ▲ Increase of a value / selection of the submenu
- ▼ Decrease of a value / selection of the submenu
- ▲ + short ▼ Change to faster scrolling up of a value
- ▼ + short ▲ Change to faster scrolling down of a value

- ▶ Short pressing: enter submenu / Change to next parameter in the menu
Short pressing: leave submenu / Change to previous parameter in the menu

- ▶ Long Pressing: Acknowledgement of an determined action
Long Pressing: Change back to the main menu

10.3 Display of the Basic Inverter



Status LED - green

| | |
|----------|-------------------------|
| Constant | Motor stopped (Standby) |
| Blinking | Motor run |

Error LED - red

The type of error is indicated by the blinking-code of the ERROR LED.

| | |
|----------|---|
| 1 blink | Undervoltage |
| 2 blinks | Overcurrent / Overload |
| 3 blinks | Inverter overheat |
| 4 blinks | Oversupply |
| 5 blinks | Code Error |
| 6 blinks | Motor overheat (external contact is open) |

For detailed information see chapter 11 Failure messages.

10.4 Software parameters

In the following chapters all available parameters of the secondary menu are listed. The first window shows the factory setting and the line below the possible settings.

The general parameter description is written for the **HYDROVAR Master Inverter** (Full featured HYDROVAR including the high level control card which supports also the optional modules like the optional Relay Card and all special software features).

When using a **HYDROVAR Single Inverter** (HYDROVAR with control card developed only for single pump operation) there are less software features in comparison to the HYDROVAR Master Inverter. All parameters which are not active for a HYDROVAR Single Inverter are marked with the following symbol:



..... Parameter not available for a HYDROVAR Single Inverter

NOTICE! All changes will be saved automatically especially in case of a disconnection of the power supply!

| | | |
|----|--------------|--|
| 00 | 00 MAIN MENU | |
|----|--------------|--|

The 1st window, REQUIRED VALUE [02] and EFFECTIVE REQUIRED VALUE [03] depend on the selected mode which has been chosen with parameter MODE [0105]. The difference between the windows in the different modes is shown below:

a) Active MODE [0105] = Controller (Default setting)

| | | | |
|--|-------------|---------------------|--|
| | ITT STOP | XX.X Hz X.XX Bar | 1 st display at mode controller |
|--|-------------|---------------------|--|

This window shows the status of the HYDROVAR.

| | | |
|------|-----------------------------------|---|
| ON | Manually and external released | Stop of the HYDROVAR by pressing ▼ |
| STOP | Manually stopped | Start of the HYDROVAR by pressing ▲ |
| OFF | External release (X3/7-8) is open | To start up the HYDROVAR close external release or bridge terminal X3/7-8 |

b) Active MODE [0105] = Cascade Relay / Cascade Serial

| | | |
|--|--|--|
| | * ADR X PX XX.X Hz STOP X.XX Bar | 1 st display at mode cascade serial and cascade relay |
|--|--|--|

This window shows the status of the HYDROVAR.



* Indicates the regulation Master

| | |
|-------|--|
| ADR X | Pump address |
| P X | Cascade relay mode: Indicates the number of pumps which are running e.g.: P3 Master + 2 fixed speed pumps are running Cascade serial mode: Indicates the sequence of the pumps in the system, depending on the MASTER PRIORITY [0570] and SWITCH INTERVAL [0555] |

| | | |
|------|-----------------------------------|---|
| ON | Manually and external released | Stop of the HYDROVAR by pressing ▼ |
| STOP | Manually stopped | Start of the HYDROVAR by pressing ▲ |
| OFF | External release (X3/7-8) is open | To start up the HYDROVAR close external release or bridge terminal X3/7-8 |

Valid for MODE – Controller / Cascade Relay / Cascade Serial

| | | |
|----|---|--|
| 02 | 02 REQUIRED VAL D1 X.XX Bar | Set the desired required value with ▲ or ▼ |
|----|---|--|

The current REQUIRED VALUE and its source (by the additional information) are shown in this window.

- D1 internal - required value 1 (specified parameter 0820)
- D2 internal - required value 2 (specified parameter 0825)
- U1 required value 1 - voltage signal input (Connected to X3/13)
- U2 required value 2 - voltage signal input (Connected to X3/15)
- I1 required value 1 – current signal input (Connected to X3/18)
- I2 required value 2 – current signal input (Connected to X3/23)

| | | |
|----|-------------------------------|--------------------------|
| 03 | 03 EFF REQ VAL D1 X.XX Bar | Effective required value |
|----|-------------------------------|--------------------------|

Shows the current required values which is calculated based on ACTUAL VALUE INCREASE [0505], ACTUAL VALUE DECREASE [0510] and LIFT AMOUNT [0330]. The required value is considering by an offset signal (SUBMENU OFFSET [0900]) the current active required value is shown in this window.

e.g. Multi-pump-application with two pumps

| | |
|-----------------------------|----------|
| REQUIRED VALUE [02]: | 5.00 bar |
| ACT. VALUE INCREASE [0505]: | 0.50 bar |
| ACT. VALUE DECREASE [0510]: | 0.25 bar |
| -> REQ VAL EFF [03]: | 5.25 bar |

After starting the second pump the pressure would be increased to a system pressure of 5.25 bar. With this parameter you are able to see the calculated new required value.

c) Active MODE [0105] = Actuator

| | | | |
|--|-------------------|---------------------|--|
| | Frequency STOP | XX.X Hz X.XX Bar | 1 st display in Mode actuator |
|--|-------------------|---------------------|--|

If parameter MODE [0105] is set to actuator the parameter REQUIRED VALUE [02] will change to ACTUAT. FREQ. 1 and is equivalent to (parameter [0830]). REQUIRED VALUE EFFECTIVE [03] will change to ACTUAT. FREQ. 2 (Parameter [0835]).

By using these parameters it is possible to run the HYDROVAR with the two pre-selected frequencies for manual control of the HYDROVAR.

| | | |
|----|-----------------------------|--|
| 02 | 02 ACTUAT.FRQ. 1 XX.X Hz | Set the desired frequency with either ▲ or ▼ |
|----|-----------------------------|--|

The selected frequency in this parameter is only active in the actuator mode if parameter C.REQ.VAL.1 [0805] is set to digital, and Parameter SW REQ.VAL [0815] is set to setpoint 1 or ACTUATOR FREQUENCY 1 selected via digital input.

For detailed information how to run the HYDROVAR by manual control, see submenu REQUIRED VALUES [0800].

| | | |
|----|-----------------------------|--|
| 02 | 02 ACTUAT.FRQ. 1 XX.X Hz | Set the desired frequency with either ▲ or ▼ |
|----|-----------------------------|--|

The selected frequency in this parameter is only active in the actuator mode if parameter C.REQ.VAL.2 [0810] is set to digital, and Parameter SW REQ.VAL [0815] is set to setpoint 2 or ACTUATOR FREQUENCY 1 selected via digital input.

For detailed information how to run the HYDROVAR by manual control, see submenu REQUIRED VALUES [0800]

Non -valid for Mode - Actuator



| | | |
|----|-----------------------|--------------------------|
| 04 | 04 START VALUE OFF | Regulation Restart Value |
|----|-----------------------|--------------------------|

Possible settings: 0 – 100 % – OFF

This parameter defines the start value after pump stop in percentage of the required value.

e.g. REQUIRED VALUE [02]: 5.0 bar
START VALUE [04]: 80 % --> 4.0 bar

If the pump system has reached the required pressure of 5.0 bar and there is no more consumption, the HYDROVAR shuts off the pump.

When the consumption increases, and the pressure drops the pump normally starts. If a START VALUE [04] of 4.0 bar has been selected the pump won't start before the pressure drops below.

The following parameters in the main-menu are valid for all selected modes:

| | | |
|----|------------------------|--------------------|
| 05 | 05 LANGUAGE ENGLISH | Language selection |
|----|------------------------|--------------------|

Possible settings: To select the desired language press ▲ or ▼

The information on the display and all parameters are available in various languages. The languages available are split in different language blocks which support different language sets.

For detailed information see chapter 4.

With the following two parameters the current date and time, can be set. That is necessary to save and display failure messages with the accurate date and time when the failure happened.

| | | |
|----|-----------------------|--------------|
| 06 | 06 DATE DD.MM.YYYY | Current date |
|----|-----------------------|--------------|

Set the date by pressing ► for approx. 5 sec.

► to set current DAY / MONTH / and YEAR.



| | | |
|----|------------------|--------------|
| 07 | 07 TIME HH:MM | Current time |
|----|------------------|--------------|

Set the time by pressing ► for approx. 5 sec.



Enter the submenu by pressing ► to set current HOUR and MINUTE.

| | | |
|-----------|-------------------------------|------------|
| 08 | 08 AUTO - START ON | Auto Start |
|-----------|-------------------------------|------------|

Possible settings: ON – OFF

Select ON with ▲ or OFF with the ▼ button.

If AUTO-START = ON the HYDROVAR starts automatically (in case of demand) after a remedy of a failure or disconnection of the power supply.

If AUTO-START = OFF the HYDROVAR won't start automatically after a remedy of a failure or disconnection of the power supply.

After remedy of the failure or reconnection of the power supply the following message is shown:

| | | | |
|--|---------------------|---------------------|----------------------------------|
| | ITT STOP | XX.X Hz X.XX Bar | Press ▲ to restart the HYDROVAR. |
|--|---------------------|---------------------|----------------------------------|

| | | |
|-----------|------------------------------------|-----------------|
| 09 | 09 OPERAT. TIME 0000 h. | Operating hours |
|-----------|------------------------------------|-----------------|

Total operatin hours. How to reset see parameter CLR OPERAT. [1135].



| | | |
|----|----------------------|-------------------------------------|
| 20 | 20 SUBMENU STATUS | Status of all units in a pump group |
|----|----------------------|-------------------------------------|

Using this submenu it is possible to check the status (including failures and motor hours) of all connected units.

| | | |
|----|-----------------------------|---------------------|
| 21 | 21 STATUS UNITS 00000000 | Status of all units |
|----|-----------------------------|---------------------|

This parameter gives a quick overview about the status of the connected units 

- In **Cascade serial** mode the status of all (max. 8) connected units is shown (whereas 1=activated / 0=deactivated)
- In **Cascade relay** mode (Master is equipped with additional Relay Card) the status of the 5 Relay- switching contacts is shown.

e.g. Mode – Cascade serial

| | | |
|--|-----------------------------|-----------------------------|
| | 21 STATUS UNITS 11001000 | Unit 1, 2 and 5 are running |
|--|-----------------------------|-----------------------------|

e.g. Mode – Cascade relay

| | | |
|--|--------------------------------|----------------------------------|
| | 21 STATUS UNITS 10100 - - - | Relay Contact 1 and 3 are closed |
|--|--------------------------------|----------------------------------|

| | | |
|----|---------------------------|---------------|
| 22 | 22 SELECT DEVICE * 1 * | Select device |
|----|---------------------------|---------------|

Possible settings: 01-08

Check the current status, the motor hours and the last failures which occurred. 

The selection is depending on the selected mode [105].

Select desired unit by pressing ▲ or ▼.

Mode CASCADE SERIAL:

The selection specifies the address of the single units

e.g. Device 01 -> Master Inverter with pre-selected address 1
Device 02 -> Basic Inverter with pre-selected address 2
Device 03 -> Basic Inverter with pre-selected address 3

For selecting desired address on a Basic Inverter, see chapter addressing.

To set the address on a Master Inverter, see submenu [1200] RS485-Interface.

**Mode CASCADE RELAY:**

| Device | | enabled by |
|--------|------------------|----------------|
| 01 | Master Inverter | |
| 02 | fixed speed pump | Relay 1 X10 /1 |
| 03 | fixed speed pump | Relay 2 X10 /2 |
| 04 | fixed speed pump | Relay 3 X10 /3 |
| 05 | fixed speed pump | Relay 4 X10 /4 |
| 06 | fixed speed pump | Relay 5 X10 /5 |
| 07 | not used | |
| 08 | not used | |

| | | |
|----|-----------------------------|-------------------------------|
| 23 | 23 STATUS DEVICE Stopped | Status of the selected device |
|----|-----------------------------|-------------------------------|

| | | |
|--------------------|---|---|
| Possible messages: | Running, Stopped, Disabled, OFF relay on, relay off Preparing, Solorun, Faulted | (Mode: Cascade Serial) (Mode: Cascade Relay) |
|--------------------|---|---|

Shows the status of the device **Mode CASCADE RELAY:**

relay on -> Relay contact is closed -> fixed-speed-pump is running
 relay off -> Relay contact is opened -> fixed-speed-pump is stopped

Mode CASCADE SERIAL:

| | | |
|-----------|----|--|
| Running | -> | Pump is running |
| Stopped | -> | Pump is stopped, because there is no request |
| Disabled | -> | Pump is stopped manually (Stopped with buttons or disabled with parameter ENABLE DEVICE [24]) or by external device (external on/off contact open) |
| OFF | -> | Pump is not connected to power supply Pump is not connected via RS485 interface |
| Preparing | -> | A new unit is connected to the multi-pump system and Data is transferred |
| Solorun | -> | Solorun is activated (X1/SL closed) |
| Faulted | -> | A failure occurred on the current unit |

| | | |
|----|----------------------------|---|
| 24 | 24 ENABLE DEVICE Enable | Enable – Disable of the selected device |
|----|----------------------------|---|

| | |
|--------------------|------------------|
| Possible settings: | Enable - Disable |
|--------------------|------------------|

The selected device can be enabled or disabled manually.
(Either in cascade relay or cascade serial mode).

| | | |
|----|--------------------------|--------------------------------------|
| 25 | 25 MOTOR HOURS XXXX h | Motor-runtime of the selected device |
|----|--------------------------|--------------------------------------|

Total time how long the motor is being powered by the HYDROVAR and basis for the switching order of the follow up pumps. How to reset see parameter CLR MOTORH. [1130].

Error memory

All errors, including these of the Basic Inverter are shown and saved at the Master Inverter in this menu. The errors saved in this menu include the failure message text of the current HYDROVAR where the failure happened, and also date and time when the failure occurred. (For more information about errors, see chapter 11 failure messages)

| | | |
|----|--------------------------|--|
| 26 | 26 1st ERROR ERROR XX | Latest error happened on selected device |
|----|--------------------------|--|

Message: ERROR XX, FAILURE TEXT, DATE, TIME

Press ▲ or ▼ to scroll up or down!

| | | |
|----|--------------------------|----------------------------------|
| 27 | 27 2nd ERROR ERROR XX | 2nd error of the selected device |
|----|--------------------------|----------------------------------|

Message: ERROR XX, FAILURE TEXT, DATE, TIME

Press ▲ or ▼ to scroll up or down!

| | | |
|----|--------------------------|----------------------------------|
| 28 | 28 3rd ERROR ERROR XX | 3rd error of the selected device |
|----|--------------------------|----------------------------------|

Message: ERROR XX. FAILURE TEXT. DATE. TIME

Press ▲ or ▼ to scroll up or down!

| | | |
|----|--------------------------|----------------------------------|
| 29 | 29 4th ERROR ERROR XX | 4th error of the selected device |
|----|--------------------------|----------------------------------|

Message: ERROR XX FAILURE TEXT DATE TIME

Press ▲ or ▼ to scroll up or down!

| | | |
|----|--------------------------|----------------------------------|
| 30 | 30 5th ERROR ERROR XX | 5th error of the selected device |
|----|--------------------------|----------------------------------|

Message: ERROR XX FAILURE TEXT DATE TIME

Press ▲ or ▼ to scroll up or down!

| | | |
|-----------|---------------------------|--|
| 40 | 40 SUBMENU DIAGNOSTICS | |
|-----------|---------------------------|--|

| | | |
|-----------|-----------------------------|---|
| 41 | 41 PROD. DATE XX.XX.XXXX | production date of the HYDROVAR (only Master) |
|-----------|-----------------------------|---|

In this parameters the current temperature, voltage and frequency of the chosen inverter can be monitored even during operation of the HYDROVAR.

These parameters are only readable!

| | | |
|-----------|-----------------------|-------------------------------|
| 42 | 42 SEL. INVERTER 1 | Selection of the desired unit |
|-----------|-----------------------|-------------------------------|

| | |
|--------------------|-----|
| Possible settings: | 1-8 |
|--------------------|-----|

| | | |
|-----------|-------------------------------------|----------------------------------|
| 43 | 43 TEMP. INVERTER XX % XX°C | Temperature of the selected unit |
|-----------|-------------------------------------|----------------------------------|

The current value determines the temperature inside the selected unit and is shown in °C and also in percent of the max. allowed temperature.

| | | |
|-----------|----------------------------|------------------------------|
| 44 | 44 CURR. INVERTER XXX % | Current of the selected unit |
|-----------|----------------------------|------------------------------|

This value determines the output current of the HYDROVAR in percent to the max. rated current output.

| | | |
|-----------|----------------------------|------------------------------|
| 45 | 45 VOLT. INVERTER XXX V | Voltage of the selected unit |
|-----------|----------------------------|------------------------------|

This value determines the output voltage.

| | | |
|-----------|----------------------------|---------------------------------------|
| 46 | 46 OUTPUT FREQ. XX.X Hz | Output frequency of the selected unit |
|-----------|----------------------------|---------------------------------------|

This value determines the output frequency supplied from the HYDROVAR at the moment.



| | | |
|----|------------------------|--|
| 60 | 60 SUBMENU SETTINGS | |
|----|------------------------|--|



Before entering the submenu settings these instructions must be read carefully to prevent incorrect settings which will cause malfunction.

All parameters can also be set during operation. Therefore different parameters in the extended submenu should be used only by trained and qualified persons.

It is suggested stopping the HYDROVAR by pressing ▼ in the main menu during changing parameters

| | | |
|----|---------------------|---|
| 61 | 61 PASSWORD 0000 | entering password (0066 = Default) by pressing ▲ or ▼ |
|----|---------------------|---|

NOTICE: The password must be entered at each entry into the submenu

| | | |
|--|---------------------|---|
| | 61 PASSWORD 0066 | Confirm by pressing ► and the first window of the sub menu is shown |
|--|---------------------|---|

| | | |
|----|--------------------------|---|
| 62 | 62 JOG 0.0Hz X.XX Bar | Both current output frequency and actual value are shown. |
|----|--------------------------|---|

- By pressing ▲ or ▼ in this menu, the internal controller of the HYDROVAR is deactivated and the inverter changes to manual mode.
- Using the ▲ and ▼ buttons any constant speed can be set without influence of the actual value of the control signal!
- If this value becomes 0.00 Hz the HYDROVAR stops.
- As soon as the window will be left by pressing ◀ or ▶, the HYDROVAR enters the selected mode.

| | | |
|--------------------|--------------------------------|---|
| 0100 | 0100 SUBMENU BASIC SETTINGS | |
| 0105 | 0105 MODE Controller | Selection of the operation mode |
| Possible settings: | | Controller, Cascade Relay, Cascade Serial, Actuator |

Controller (Default Setting):

This mode should be selected if only one HYDROVAR Master-Inverter is in operation and there is no connection to any other HYDROVARs via RS-485 interface.

Cascade Relay:

The standard application for this mode is one Master-Inverter fitted with an additional Relay Card to control up to 5 fixed speed pumps.

No connection to any other HYDROVAR via RS-485 Interface possible.

Advantages: costs, realizing of simple systems

Disadvantage: quality of regulation, reliability

Cascade Serial:

If more than one speed controlled pump has to operate together via the RS-485 interface, this mode must be selected.

The standard application for this mode is a multi-pump system with up to 8 pumps, each fitted with a HYDROVAR Master Inverter or a combination of Master and Basic Inverters.

Advantages: reliability, switchover for operating hours optimizing, switching over in case of a failure

Actuator: (For single pump operation only!)

The actuator mode has to be used if an external speed signal is available and the HYDROVAR is just used like a standard frequency converter.

In this case, the internal controller is shut off, so the HYDROVAR won't control the set value but it is responsible for running the connected motor at a frequency proportional to the input signal connected to the analogue inputs:

| | | |
|--|--------|-------------------------------|
| X3/13: Voltage signal input (Required value 1) | 0-10V | MIN.FREQ.[250]-MAX.FREQ.[245] |
| X3/15: Voltage signal input (Required value 2) | 0-10V | MIN.FREQ.[250]-MAX.FREQ.[245] |
| X3/18: Current signal input (Required value 1) | 4-20mA | MIN.FREQ.[250]-MAX.FREQ.[245] |
| | 0-20mA | MIN.FREQ.[250]-MAX.FREQ.[245] |
| X3/23: Current signal input (Required value 2) | 4-20mA | MIN.FREQ.[250]-MAX.FREQ.[245] |
| | 0-20mA | MIN.FREQ.[250]-MAX.FREQ.[245] |

- A manual switching between the analogue inputs is possible by using the corresponding digital inputs.
- The frequency varies not faster than the programmed Ramps 1 (accelerative) and 2 (declarative). The functions thermal protection and external ON/OFF remain still active.
- The functions "External ON/OFF", "Motor Overheat", "Lack of water" and all other internal protections still work.

In the actuator mode it is also possible to work with pre-selected frequencies for a manual control of the HYDROVAR. It is possible to set two different frequencies in the submenu REQUIRED VALUES [0800]. A changeover of these frequencies can be done with parameter SW REQ. VAL [0815].

| | | |
|--------------------|-------------------------|---------------------------------|
| 0110 | 0110 SET PASSW. 0066 | Set Password by pressing ▲ or ▼ |
| Possible settings: | 0000 - 9999 | |

The pre-set password (0066) can be changed.

After the password has been changed, it is recommended to make some notes about the new password.

| | | |
|--------------------|-------------------------|-------------------------------|
| 0115 | 0115 LOCK FUNCT. OFF | Possible settings with ▲ or ▼ |
| Possible settings: | ON - OFF | |

OFF: All parameters in the main menu can be changed without the need of a password.

ON: If the LOCK FUNCTION is activated, no changes can be done in the main menu.

The HYDROVAR can be just started or stopped by using the push buttons (▲ or ▼). In order to change the set value, the LOCK FUNCTION must be reset to OFF.

| | | |
|-------------|---------------------------|------------------|
| 0120 | 0120 DISP. CONTR. 75 % | Display Contrast |
|-------------|---------------------------|------------------|

Possible settings: 10 – 100%

Can be adjusted between 10 - 100%, for improved readability of the display depending on the installation position.

| | | |
|-------------|----------------------------|--------------------|
| 0125 | 0125 DISP. BRIGHT 100 % | Display Brightness |
|-------------|----------------------------|--------------------|

Possible settings: 10 – 100%

The backlight intensity of the display can be adjusted.

| | | |
|-------------|-------------------------------|--|
| 0200 | 0200 SUBMENU CONF INVERTER | |
|-------------|-------------------------------|--|

| | | |
|-------------|-----------------------|-------------------------|
| 0205 | 0205 MAX. UNITS 01 | Maximum number of units |
|-------------|-----------------------|-------------------------|

| | | |
|--------------------|---------|-------------------------------------|
| Possible settings: | 01 - 08 | <input checked="" type="checkbox"/> |
|--------------------|---------|-------------------------------------|

Select: The maximum number of units which can operate at the same time.



For example:

Cascade Serial:

1 Master- and 2 Basic Inverters are installed in a multi-pump-system
→ reasonable values = 1...3

Cascade Relay:

1 Master Inverter and 3 fixed speed pumps -> reasonable values = 2...4

| | | |
|-------------|----------------------|--|
| 0210 | 0210 INVERTER ALL | Selection of the Power Unit for parameterizing |
|-------------|----------------------|--|

| | | |
|--------------------|----------|-------------------------------------|
| Possible settings: | ALL, 1-8 | <input checked="" type="checkbox"/> |
|--------------------|----------|-------------------------------------|

If several HYDROVAR Master Inverters and even Basic Inverters are connected via the RS-485 interface, the parameterization of the volumes of SUMBENU [200] can be done via one unit and will be taken over by other units in this group.



If only a specific unit has to be programmed you have to push the ► button for 5 sec. and chose afterwards this unit (1-8) for which the parameterization should be done.

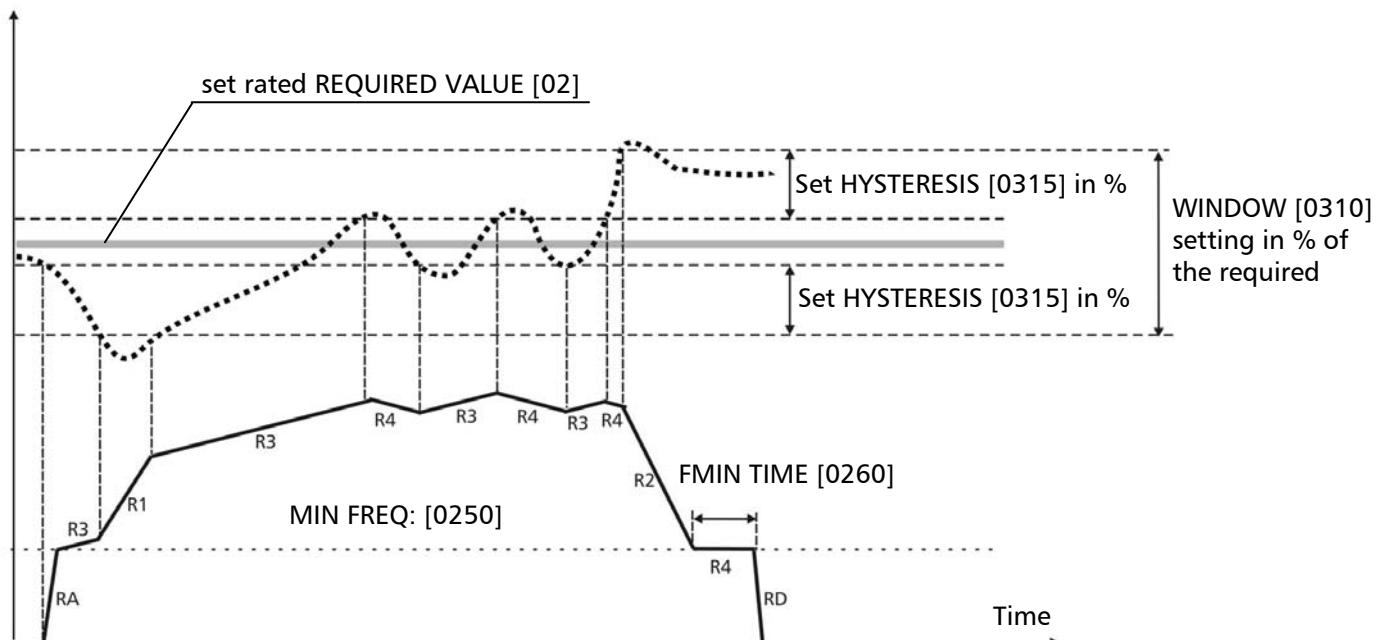
At setting "ALL" every device in the group is addressed.

Be careful, if you change back to ALL the configuration of this set will be reloaded!

Ramp settings:

- Time settings of the ramps influence the control of the pump and shouldn't be changed for standard operation.
- The fast ramps 1 and 2 are determined by the type (power) of the HYDROVAR and the type of the pump.
Default = 4 sec.; depending on the power of the HYDROVAR they should be increased up to 15s for higher power ratings to avoid overload switch off
- The slow ramps 3 and 4 determine the regulation speed of the internal HYDROVAR controller for small devices or constant consumption and depend on the system, which has to be controlled. (Default = 70 sec.)
- The Ramps FminA and FminD are used for a start-up and shut off. These parameters allow fast acceleration and deceleration and especially should be used for applications where pumps or other devices are powered, which shouldn't work below a determined frequency for a certain time. (to prevent damages or decrease abrasion)

To adjust the Ramps, press ▲ or ▼



RA: Ramp F_{\min} acceleration

.....
—

Actual Value
Output Frequency

RD: Ramp F_{\min} Deceleration

R1: Ramp 1 – speed ramp fast increase

R2: Ramp 2 – speed ramp fast decrease

R3: Ramp 3 – speed ramp slow increase

R4: Ramp 4 – speed ramp slow decrease

| | | |
|-------------|----------------------|--------------------------------|
| 0215 | 0215 RAMP 1 4 Sec | Ramp 1: Fast acceleration time |
|-------------|----------------------|--------------------------------|

| | |
|--------------------|-------------|
| Possible settings: | 1 – 250 sec |
|--------------------|-------------|

- Excessively fast running up time may cause an error (OVERLOAD) during the HYDROVAR starts up.
- Excessively slow running up time may cause a drop of the outgoing pressure during operation.

| | | |
|-------------|----------------------|--------------------------------|
| 0220 | 0220 RAMP 2 4 Sec | Ramp 2: Fast deceleration time |
|-------------|----------------------|--------------------------------|

| | |
|--------------------|-------------|
| Possible settings: | 1 – 250 sec |
|--------------------|-------------|

- Excessively fast running down time tends to cause an error (OVERVOLTAGE)
- Excessively slow running down time tends to generate over pressure.

| | | |
|-------------|-----------------------|--------------------------------|
| 0225 | 0225 RAMP 3 70 Sec | Ramp 3: Slow acceleration time |
|-------------|-----------------------|--------------------------------|

| | |
|--------------------|-------------|
| Possible settings: | 1 – 250 sec |
|--------------------|-------------|

- Excessively fast running up time may lead to oscillation and/or an error (OVERLOAD).
- Excessively slow running up time can cause a drop of the outgoing pressure during variation of the demand.

| | | |
|-------------|-----------------------|--------------------------------|
| 0230 | 0230 RAMP 4 70 Sec | Ramp 4: Slow deceleration time |
|-------------|-----------------------|--------------------------------|

| | |
|--------------------|-------------|
| Possible settings: | 1 – 250 sec |
|--------------------|-------------|

- Excessively fast running down time leads to oscillation of the HYDROVAR and thereby of the pump.
- Excessively slow running down time can cause pressure fluctuations during variation of the demand.

| | | |
|-------------|-----------------------------|-----------------------------|
| 0235 | 0235 RAMP FMIN A 2.0 Sec | Ramp F_{min} acceleration |
|-------------|-----------------------------|-----------------------------|

Possible settings: 1.0 – 25.0 sec

Fast running up time to start up the HYDROVAR till the selected MIN. FREQUENCY [0250] is reached.

Above the minimum frequency, RAMP1 [0215] (fast acceleration ramp) starts to work.

- Excessively fast running up time may cause an error (OVERLOAD) during the HYDROVAR starts up.

| | | |
|-------------|-----------------------------|-----------------------------|
| 0240 | 0240 RAMP FMIN D 2.0 Sec | Ramp F_{min} deceleration |
|-------------|-----------------------------|-----------------------------|

Possible settings: 1.0 – 25.0 sec

Fast running down time, to stop the HYDROVAR immediately below the selected MIN. FREQUENCY [0250].

- Excessively fast running down time tends to cause an error (OVERVOLTAGE)

| | | |
|-------------|---------------------------|-------------------|
| 0245 | 0245 MAX. FRQ. 50.0 Hz | Maximum frequency |
|-------------|---------------------------|-------------------|

Possible settings: 30.0 – 70.0 Hz

This parameter determines the maximum speed of the pump.

The standard setting is according to the nominal frequency of the connected motor.



Settings higher than standard setting may overload the motor!
Settings of 10% above nominal frequency cause 33% higher power consumption!

| | | |
|-------------|---------------------------|-------------------|
| 0250 | 0250 MIN. FRQ. 15.0 Hz | Minimum frequency |
|-------------|---------------------------|-------------------|

Possible settings: 0.0 – 30.0Hz

At operation below the set min. frequency the HYDROVAR operates with the fast ramps [0235/0240].



The min. frequency depends on the selected pump type and application.
Especially for borehole applications the min. frequency must be set to ~30Hz.



| | | |
|------|---------------------------|--------------------------------|
| 0255 | 0255 CONF. FMIN f -> 0 | Operation at minimum frequency |
|------|---------------------------|--------------------------------|

| | |
|--------------------|-----------------------|
| Possible settings: | f->0 or f-> f_{min} |
|--------------------|-----------------------|

f->0: After reaching the required pressure and consumption "0" the frequency will go down to the selected MINIMUM FREQUENCY [0250] and the HYDROVAR will keep running for the selected FMIN TIME [0260]. After this time the HYDROVAR will stop automatically.

f-> f_{min} : With this setting the pump will never stop automatically. Only the frequency will go down to the selected MINIMUM FREQUENCY [0250]. To stop the pump the external ON/OFF must be opened or the ▼ button must be pressed.

Applications: circulation systems

The setting f-> f_{min} can overheat the pump, when there is no flow through the pump. => bypass line for circulation pumps!

| | | |
|------|-----------------------|--|
| 0260 | 0260 FMIN TIME 0 s | Delay time to shut off below minimum frequency |
|------|-----------------------|--|

| | |
|--------------------|-------------|
| Possible settings: | 0 – 100 sec |
|--------------------|-------------|

After running the pump for this selected time at minimum frequency, the pump will stop, if parameter CONFIG. FMIN [0255] is set to f -> 0

NOTICE: Problems with shut off the pump at 0 demand (too small or no pressure tank) may be solved as the system pressure is increasing during this delay-time.

| | | |
|------|-------------------|--|
| 0265 | 0265 BOOST 5 % | Setting of the motor starting voltage in % of connected supply voltage |
|------|-------------------|--|

| | |
|--------------------|------------------------------|
| Possible settings: | 0 – 25% of the input voltage |
|--------------------|------------------------------|

This parameter determines the characteristics of the voltage/frequency curve. In particular, it refers to the voltage increase during the motor starting stage as a percentage of the nominal voltage. Take care that settings are kept as low as possible so that the motor does not become thermally overloaded at lower frequencies. If the boost is set too low, a failure (OVERLOAD) may occur because the starting-current is too high.



| | | |
|------|---------------------------|----------------|
| 0270 | 0270 KNEE FRQ. 50.0 Hz | Knee frequency |
|------|---------------------------|----------------|

Possible settings: 30.0 – 70.0 Hz

With this parameter you can set the frequency, at which the HYDROVAR should deliver its maximum output voltage (**for special applications only!**).

For standard applications this frequency should be set according the MAX. FRQ. [0245] (Default Setting 50Hz).



**Be careful: This parameter should be used for special applications only!
Incorrect setting can cause an overload error and even a damage of the motor.**

| | | |
|------|---------------------------|---|
| 0275 | 0275 POWER REDUCT. OFF | Reduction of the maximum output current |
|------|---------------------------|---|

Possible settings: OFF, 85%, 75%, 50%

If a motor with lower nominal power is used, the maximum output current should be adjusted accordingly.

The reduction of the maximum output current also affects the overload-detection!

| HV Type | Output current [A] | | | |
|---------|--------------------|-------|-------|------|
| | OFF = 100% | 85% | 75% | 50% |
| 2.015 | 7 | 5,95 | 5,25 | 3,5 |
| 2.022 | 10 | 8,50 | 7,50 | 5,00 |
| 4.022 | 5,7 | 4,85 | 4,28 | 2,85 |
| 4.030 | 7,3 | 6,21 | 5,48 | 3,65 |
| 4.040 | 9 | 7,65 | 6,75 | 4,5 |
| 4.055 | 13,5 | 11,48 | 10,13 | 6,75 |
| 4.075 | 17 | 14,45 | 12,75 | 8,5 |
| 4.110 | 23 | 19,55 | 17,25 | 11,5 |

| | | |
|------|--------------------------|--------------------------------------|
| 0280 | 0280 SEL.SW.FRQ. Auto | Selection of the switching frequency |
|------|--------------------------|--------------------------------------|

Possible settings: Auto, 8 kHz, 4 kHz

- **Auto (default setting)**

In standard operation the HYDROVAR works with a switching frequency of 8kHz in order to reduce the noise level. At rising temperature inside the HYDROVAR the switching frequency is decreased to 4kHz automatically.

- **8kHz** - Selection with lowest noise level, but without decrease at rising temperature.

- **4kHz** - Reduce the temperature in the motor and even inside the inverter.

| | | |
|-------------|----------------------------|--|
| 0300 | 0300 SUBMENU REGULATION | |
|-------------|----------------------------|--|

| | | |
|-------------|---------------------------------|---|
| 0305 | 0305 JOG 0.0Hz X.XX Bar | Both current output frequency and actual value are shown. |
|-------------|---------------------------------|---|

- By pressing ▲ or ▼ in this menu, the internal controller of the HYDROVAR will be shut off and the inverter changes to manual mode.
- With the ▲ and ▼ buttons any constant speed can be set without influence of the actual value of the control signal!
- If this value becomes 0.00 Hz the HYDROVAR stops.
- As soon as the window will be left by pressing ◀ or ▶, the HYDROVAR restart normal mode.

| | | |
|-------------|---------------------|-------------------|
| 0310 | 0310 WINDOW 10 % | regulation Window |
|-------------|---------------------|-------------------|

| | |
|--------------------|----------------------------|
| Possible settings: | 0 – 100% of required value |
|--------------------|----------------------------|

- Determines the band, where the slow ramp changes to the fast ramp
- for steep pump-curves and closed loop systems ~20-30%

| | | |
|-------------|------------------------|---------------|
| 0315 | 0315 HYSTERESIS 80% | ramp Hysteric |
|-------------|------------------------|---------------|

| | |
|--------------------|----------|
| Possible settings: | 0 – 100% |
|--------------------|----------|

- Determines the band, where the normal regulation is done (change between the slow ramps)
- for an accurate control (without automatic shut-off) ~99%, e.g. constant flow control

| | | |
|-------------|--------------------------|-----------------|
| 0320 | 0320 REG. MODE normal | Regulation mode |
|-------------|--------------------------|-----------------|

| | |
|--------------------|----------------|
| Possible settings: | normal, invers |
|--------------------|----------------|

Normal: Speed is increased with falling actual value signals. (e.g.: control at constant output pressure)

Inverse: Speed is reduced with falling actual value signal. (e.g.: control at constant suction pressure or at constant level on the suction side)



| | | |
|------|---------------------------|---|
| 0325 | 0325 FRQ. LIFT 30.0 Hz | Frequency limit for required lift value |
|------|---------------------------|---|

Possible settings: 0.0 Hz – 70.0 Hz

Control according to a system curve (increase of the set pressure, depending on the delivery rate or speed to cover friction losses).

The setting determines the output-frequency where the set pressure starts to be increased. The right setting should be equal to the frequency when the pump reaches the set pressure at zero flow. (can be determined by using the JOG MODE [0305])

| | | |
|------|---------------------------|-------------------------------------|
| 0330 | 0330 LIFT AMOUNT 0.0 % | Lift amount for required lift value |
|------|---------------------------|-------------------------------------|

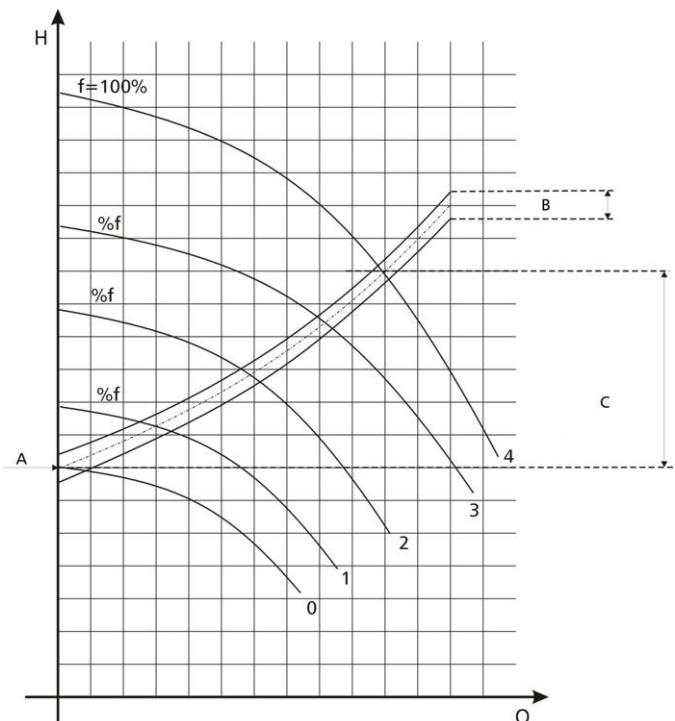
Possible settings: 0.0 – 200.0%

This value states how much the set value should be continually increased, till the maximum speed (maximum volume) is reached.

Application example:

- 1) Enter the set pressure (see main menu parameter REQ. VAL[02])
- 2) Find out the frequency where set pressure is reached at zero demand (use JOG MODE [0305]) and set the value in parameter FREQU. LIFTING
- 3) Set desired lift at maximum speed in % of the set pressure in the parameter LIFT-AMOUNT [0330].

A ... set pressure
B ... window
C ... lift intensity in % of set pressure





| | | |
|------|------------------------|--|
| 0400 | 0400 SUBMENU SENSOR | |
|------|------------------------|--|

In this submenu all actual value sensors which are connected to the HYDROVAR can be configured. (Either two transducers with current signal input or voltage signal input)

It isn't possible to install two different transducer types because configurations are the same for all connected sensors.

| | | |
|------|--------------------------|----------------|
| 0405 | 0405 DIMENS. UNIT Bar | Dimension unit |
|------|--------------------------|----------------|

Possible settings: bar, psi, m³/h, g/min, mH₂O, ft, °C, °F, l/sec, l/min, m/sec, ..., %

Chose the desired Dimension Unit by pressing ▲ or ▼.

By changing the DIMENSION UNIT, you have to consider to change the SENSOR RANGE [0420] according to the new DIMENSION UNIT too!

| | | | |
|------|------------------------------|-------------------------|---------------------------------------|
| 0410 | 0410 CONF SENSOR Sensor 1 | Selection of the sensor | <input checked="" type="checkbox"/> S |
|------|------------------------------|-------------------------|---------------------------------------|

Possible settings:

| | | |
|---------------|---------------|-------------------------|
| - Sensor 1 | - Sensor 2 | - Auto |
| - Switch Dig1 | - Switch Dig2 | - Switch Dig3 |
| - Auto Lower | - Auto Higher | - (Sensor 1 – Sensor 2) |

This parameter determines how the connected sensors are used and which one is active. It is also possible to measure the difference of two connected sensors or to configure an automatic switchover in case of a faulty sensor.

| | |
|-----------------|---|
| Sensor 1 | Sensor 1 is constantly active. 0/4-20mA signal connected to X3/2 and X3/3 (+24V) 0-10V signal connected to X3/6 and X3/3 (+24V) |
| Sensor 2 | Sensor 2 is constantly active. 0/4-20mA signal connected to X3/4 and X3/3 (+24V) 0-10V signal connected to X3/5 and X3/3 (+24V) |
| Auto | Automatic switch over in case of a faulty transmitter. |
| Switch Dig1 | Manual switching by closing digital input 1 (X3/9-10) |
| Switch Dig2 | Manual switching by closing digital input 2 (X3/6-GND) |
| Switch Dig3 | Manual switching by closing digital input 3 (X3/5-GND) |
| Switch Dig4 | Manual switching by closing digital input 4 (X3/15-GND) |
| Auto Lower | The sensor with the lower actual value (or available sensor in case of a faulty sensor) is used automatically |
| Auto Higher | The sensor with the higher actual value (or available sensor in case of a faulty sensor) is used automatically |
| Sens.1 – Sens.2 | The difference of both connected sensors is taken as actual value |

| | | |
|-------------|------------------------------|---|
| 0415 | 0415 SENSOR TYPE 4 – 20mA | Selection of the sensor type and input terminal |
|-------------|------------------------------|---|

Possible settings: - analog I 4-20mA - analog I 0-20mA - analog U 0-10V

For correct operation the suitable signal input type regarding to the connected sensor has to be selected.

| Sensor type: | | Terminals: |
|--|---|--|
| - analog I 4-20mA - analog I 0-20mA | The actual value is represented by a current signal connected to following terminals: | X3/2 -> Sensor 1 * X3/4 -> Sensor 2 |
| - analog U 0-10V | The actual value is given from a voltage signal connected to following terminals: | X3/6 -> Sensor 1 * X3/5 -> Sensor 2 |

* ... Sensor 2 isn't available for the Single Inverter configuration

| | | |
|-------------|--------------------------------------|--------------|
| 0420 | 0420 SENS. RANGE 20mA = 10.00 Bar | Sensor range |
|-------------|--------------------------------------|--------------|

Possible settings: 0.00 – 10000

Determines the end value (=20mA or 10V) of the connected sensor.

The maximum sensor range -> 20mA = 100% of the sensor range must be set.

For example:

| | |
|--|-------------------|
| 10 bar pressure transducer | => 20mA = 10bar |
| 0.4 bar differential pressure transducer | => 20mA = 0.4 bar |
| Flowmeter (Flowrate= 36m³/h) | => 20mA = 36m³/h |

| | | |
|-------------|----------------------------|--------------|
| 0425 | 0425 SENS. CURVE linear | Sensor curve |
|-------------|----------------------------|--------------|

Possible settings: linear, quadratic

Internal calculation based on the actual value

Possible Setting and its application:

- **linear:** Pressure control, differential pressure control, level, temperature and flow control (inductive or mechanical).
- **quadratic:** Flow control using an orifice plate together with a differential pressure transmitter.

| | | |
|-------------|------------------------------------|---------------------------------|
| 0430 | 0430 SENS 1 CAL0 0% = 00.00 bar | Sensor 1 zero point calibration |
|-------------|------------------------------------|---------------------------------|

| | |
|--------------------|--------------------------------------|
| Possible settings: | - 10% up to +10% of the sensor range |
|--------------------|--------------------------------------|

This parameter is used to calibrate the minimum value of Sensor 1.

After setting the dimension unit and the sensor range the zero point for this sensor can be adjusted. Adjustable range between -10 % and +10 % of the sensor range.

e.g. DIMENS. UNIT [0405] = bar
 SENS. RANGE [0420] = 10.00 bar
 SENS 1 CAL0 [0430] = 2% -> 00,20 bar

| | | |
|-------------|------------------------------------|--|
| 0435 | 0435 SENS 1 CALx 0% = 10.00 bar | Sensor 1 upper range value calibration |
|-------------|------------------------------------|--|

| | |
|--------------------|--------------------------------------|
| Possible settings: | - 10% up to +10% of the sensor range |
|--------------------|--------------------------------------|

To set the calibration for the upper range value of sensor 1, this parameter can be used.
 After setting the right dimension unit and sensor range the upper range value can be adjusted between -10 and +10% of the sensor range.

e.g. DIMENS. UNIT [0405] = bar
 SENS. RANGE [0420] = 10.00 bar
 SENS 1 CAL0 [0430] = -2% -> 09,80 bar

| | | |
|-------------|------------------------------------|---------------------------------|
| 0440 | 0440 SENS 2 CAL0 0% = 00.00 bar | Sensor 2 zero point calibration |
|-------------|------------------------------------|---------------------------------|

| | |
|--------------------|--------------------------------------|
| Possible settings: | - 10% up to +10% of the sensor range |
|--------------------|--------------------------------------|

Zero point calibration for Sensor 2, for explanation see Parameter 0430. 

| | | |
|-------------|------------------------------------|--|
| 0445 | 0445 SENS 2 CALx 0% = 10.00 bar | Sensor 2 upper range value calibration |
|-------------|------------------------------------|--|

| | |
|--------------------|--------------------------------------|
| Possible settings: | - 10% up to +10% of the sensor range |
|--------------------|--------------------------------------|

Upper range calibration for Sensor 2, for explanation see Parameter 0435. 

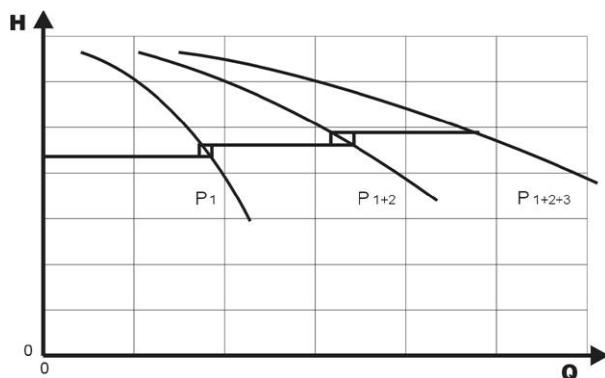
| | | |
|------|--------------------------------|--|
| 0500 | 0500 SUBMENU SEQUENCE CNTR. | |
|------|--------------------------------|--|



Using the parameters of this submenu, all necessary settings can be done for running a multi-pump system (even in cascade relay and cascade serial mode).

Application Example:

- 1) Lead pump reaches its ENABLE FREQUENCY [0515]
- 2) Actual value falls and reaches the cut in-value of the 1st follow up pump
 Cut in-value = REQUIRED VALUE [02] – ACT. VAL. DEC. [0510]
 → the 1st follow up pump is switched on automatically
- 3) After the start up the new required value is calculated in the following way:
 NEW REQUIRED VALUE = REQ.VAL.[02] – ACT.VAL.DEC[0510] + ACT.VAL.INC.[0505].
 The new required value is shown in the main menu as parameter EFF.REQ.VAL.[03].



Calculations of the new required value for multi pump applications:

$$k \dots \text{Number of active pumps } (k > 1)$$

$$p = p_{\text{set}} + (k-1) * [\text{lift value} - \text{fall value}]$$

- Lift value = Fall value ⇒ **Pressure constant** independent how many pumps are in operation
- Lift value > Fall value ⇒ **Pressure rises** when lag-pump switches on
- Lift value < Fall value ⇒ **Pressure falls** when lag-pump switches on



The following 3 parameters are responsible for starting the lag pumps and for calculation of the new required value as well.

| | | | |
|------|-------------------------------|------------|---------------------------------------|
| 0505 | 0505 ACT.VAL.INC. 0.35 Bar | Lift value | <input checked="" type="checkbox"/> S |
|------|-------------------------------|------------|---------------------------------------|

| | |
|--------------------|---|
| Possible settings: | 0.00 – to the pre selected sensor range |
|--------------------|---|

| | | | |
|------|-------------------------------|------------|---------------------------------------|
| 0510 | 0510 ACT.VAL.DEC. 0.15 BAR | Fall value | <input checked="" type="checkbox"/> S |
|------|-------------------------------|------------|---------------------------------------|

| | |
|--------------------|--|
| Possible settings: | 0.00– to the pre selected sensor range |
|--------------------|--|

| | | | |
|------|----------------------------|--|---------------------------------------|
| 0515 | 0515 ENABLE FRQ 48.0 Hz | enable frequency for the next power unit | <input checked="" type="checkbox"/> S |
|------|----------------------------|--|---------------------------------------|

| | |
|--------------------|---------------|
| Possible settings: | 0.0 – 70.0 Hz |
|--------------------|---------------|

Using this parameter the desired release frequency for the following pumps can be selected. If a pump in the system reaches this frequency and the system pressure drops below the REQUIRED VALUE [02] - ACTUAL VALUE DECREASE [0510], the next pump is started.

| | | | |
|------|--------------------------|--|--|
| 0520 | 0520 ENABLE DLY 5 sec | Enable delay time (for cascade relay only!) | |
|------|--------------------------|--|--|

| | |
|--------------------|-------------|
| Possible settings: | 0 – 100 sec |
|--------------------|-------------|

If the conditions for switching on a follow up pump are satisfied, the follow-up- pump will start after this selected time.

| | | | |
|------|------------------------|---|--|
| 0525 | 0525 SW DELAY 5 sec | Switch delay (for cascade relay only!) | |
|------|------------------------|---|--|

| | |
|--------------------|-------------|
| Possible settings: | 0 – 100 sec |
|--------------------|-------------|

Delay time between two switching actions of the follow-up-pumps.
That parameter prevents the system against repeated switching actions caused by the variation of the consumption.



| | | |
|-------------|---------------------------|--|
| 0530 | 0530 DISABLE FRQ 30 Hz | Disable frequency (for cascade relay only!) |
|-------------|---------------------------|--|

Possible settings: 0.0 – 120.0 Hz 

The frequency to switch off the fixed speed pumps in cascade relay- mode can be set by this parameter.

If the Master Inverter goes below that frequency for longer than the pre-selected DISABLE DLY [0535] and the system pressure is higher than the EFFECTIVE REQ. VALUE [03] (REQUIRED VALUE [02] + ACTUAL VAL. INC [0505]), the first follow-up-pump stops.

| | | |
|-------------|---------------------------|---|
| 0535 | 0535 DISABLE DLY 5 sec | Disable delay time (for cascade relay only!) |
|-------------|---------------------------|---|

Possible settings: 0 – 100 sec 

Delay time before switching off the follow up pumps in cascade relay mode.

| | | |
|-------------|------------------------|---|
| 0540 | 0540 DROP FRQ 42 Hz | Drop frequency (for cascade relay only!) |
|-------------|------------------------|---|

Possible settings: 0.0 – 70.0 Hz 

This parameter is used to prevent the system from pressure hammers. Before a following pump starts up, the Master Inverter will drop to the selected frequency. If the DROP FREQUENCY is reached, the follow-up-pump gets released and the Master Inverter will continue with normal operation.

| | | |
|-------------|-----------------------|--|
| 0545 | 0545 OVERVALUE OFF | Overvalue (for cascade relay only!) |
|-------------|-----------------------|--|

Possible settings: OFF – pre selected Sensor range 

If this selected value is reached, an immediate shut-off of the follow-up-pumps is executed.

e.g. REQUIRED VALUE [02]: 5.00 bar
OVERVALUE [0545]: 7.50 bar

If three pumps are running (1 Master Inverter + 2 follow-up-pumps) and a system pressure of 7.50 bar is reached, one after another follow-up-pumps shuts off.

This parameter prevents the system against overpressure in case the HYDROVAR has been parameterized incorrectly.



| | | |
|-------------|---------------------------|--|
| 0550 | 0550 OVERVAL DLY 0 sec | Overvalue delay (for cascade relay only!) |
|-------------|---------------------------|--|

| | |
|--------------------|----------------|
| Possible settings: | 0.0 – 10.0 sec |
|--------------------|----------------|

Delay time to switch-off a follow-up-pump in case the actual value exceeds the OVERVALUE [0545] limit.



| | | |
|-------------|------------------------------|--|
| 0555 | 0555 SWITCH INTV 24 hours | Switch interval for cyclic changeover (for cascade serial only!) |
|-------------|------------------------------|--|

| | |
|--------------------|---------------|
| Possible settings: | 0 – 250 hours |
|--------------------|---------------|

This parameter allows an automatic change over of the master pump and the following pumps, in order to provide even wear and achieve even operating hours of the pumps.



The switch interval is valid for HYDROVAR Master Inverters only (connected via the RS-485 interface) and using operation mode Cascade Serial.

| | | |
|-------------|------------------------|--|
| 0570 | 0570 MSTPRIORITY ON | Master priority (for cascade serial only!) |
|-------------|------------------------|--|

| | |
|--------------------|----------|
| Possible settings: | ON - OFF |
|--------------------|----------|

This parameter determines the switching order when master and Basic Inverters are used together. In such a case you have to choose if the master or the Basic Inverters should be switched on first.



ON- All Master Inverters in the system are released (unless it is stopped by a failure or manually) before the first Basic Inverter gets released.

For example: Address 1-3.....Master Inverters
 Address 4-8.....Basic Inverters

| | | | | | | | | |
|-------------------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------------|
| <u>Switching order:</u> | Adr 1 Master | Adr 2 Master | Adr 3 Master | Adr 4 Basic | Adr 5 Basic | Adr 6 Basic | Adr 7 Basic | Adr 8 Basic |
|-------------------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------------|

OFF- One master (which is responsible for the controlling according the set value) is running. With rising consumption all Basic Inverters have to be released before any other Master starts running.

| | | | | | | | | |
|-------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|
| <u>Switching order:</u> | Adr 1 Master | Adr 4 Basic | Adr 5 Basic | Adr 6 Basic | Adr 7 Basic | Adr 8 Basic | Adr 2 Master | Adr 3 Master |
|-------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|



| | | |
|------|------------------------|--|
| 0600 | 0600 SUBMENU ERRORS | |
|------|------------------------|--|

| | | |
|------|-------------------------------|-------------------------|
| 0605 | 0605 MIN. THRESH. disabled | minimum threshold limit |
|------|-------------------------------|-------------------------|

| | |
|--------------------|------------------------------|
| Possible settings: | disabled - max. SENSOR RANGE |
|--------------------|------------------------------|

- An adjusted value >0.00 has to be reached within the programmed DELAY TIME [0610]
- If this value can't be reached, the HYDROVAR stops and indicates the failure message "MIN. THRESHOLD ERROR".
- To disable the minimum threshold limit, press ▼ till "disabled" is shown on the display.

| | | |
|------|----------------------------|------------------------------------|
| 0610 | 0610 DELAY - TIME 2 Sec | minimum threshold limit delay time |
|------|----------------------------|------------------------------------|

| | |
|--------------------|-------------|
| Possible settings: | 0 – 100 sec |
|--------------------|-------------|

Delay time to switch-off the HYDROVAR in case the actual value drops below the min. threshold limit or a connected external low water protection at terminals X3/11-12 has been opened.

Notice: The min. threshold function is also active during start up of the pump! Therefore the delay time has to be set higher than the duration that is needed, to reach a value higher than that.

| | | |
|------|------------------------|-----------------------|
| 0615 | 0615 ERROR RESET ON | Automatic error reset |
|------|------------------------|-----------------------|

| | |
|--------------------|----------|
| Possible settings: | ON – OFF |
|--------------------|----------|

ON: Allows an automatic restart for 5 times in case of a failure. If the failure is still active after the 5th restart, the HYDROVAR will shut off and the appropriate error message is shown.

The internal counter of the automatic error reset is decreased by 1 after each operating hour, so if an error could be reset after 3 restarts, there are 3 further restarts possible after one hour, 4 after two hours and 5 automatic restarts after 3 operating hours.

A manual reset can be done by switching an external ON/OFF (X3/7-8) contactor.

Not each error can be reset automatically.
(For detailed information see chapter 11 failure messages)

OFF: if the ERROR RESET is set to OFF, each failure would be shown on the display directly and must be reset manually.

| | | |
|-------------|-------------------------|--|
| 0700 | 0700 SUBMENU OUTPUTS | |
|-------------|-------------------------|--|

| | | | |
|-------------|--------------------------------------|------------------|--|
| 0705 | 0705 ANALOG OUT1 Output Frequency | Analoge output 1 | <input checked="" type="checkbox"/> S |
|-------------|--------------------------------------|------------------|--|

Analogue output 0 – 10V = 0 - 100%

Terminal: X3/20

Possible settings:

- Actual value
- Output frequency (0 - fmax)

| | | | |
|-------------|----------------------------------|------------------|--|
| 0710 | 0710 ANALOG OUT2 Actual value | Analoge output 2 | <input checked="" type="checkbox"/> S |
|-------------|----------------------------------|------------------|--|

Possible settings:

Actual Value, Output frequency

Analogue output 4 – 20mA = 0 - 100%

Terminal: X3/21

Possible settings:

- Actual value
- Output frequency (0 - fmax)

| | | |
|-------------|----------------------------|--|
| 0715 | 0715 CONF REL 1 Running | Configuration of the Status Relay 1 (X5/1-2-3) |
|-------------|----------------------------|--|

| | | |
|-------------|----------------------------|--|
| 0720 | 0720 CONF. REL 2 Errors | Configuration of the Status Relay 2 (X5/4-5-6) |
|-------------|----------------------------|--|

Possible settings:

Power, Errors, Warnings, StandBy, Errorreset

Both Status-Relays can be used to indicate the current status and fault condition of the HYDROVAR.

| Config. | Explanation | Action |
|------------|---|--|
| Power | HYDROVAR is connected to power supply | Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed |
| Running | Motor is running | Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed |
| Errors | An error is indicated on the HYDROVAR | Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed |
| Warnings | A warning is indicated on the HYDROVAR | Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed |
| StandBy | Pump is released manually and by external release, no error/warning is indicated and HYDROVAR doesn't run | Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed |
| Errorreset | If Parameter ERRORRESET [0615] is activated and a Warning occurs 5 times -> Error -> | Relay1: X5/ 1-3 closed Relay2: X5/ 4-6 closed |



| | | |
|-------------|---------------------------------|--|
| 0800 | 0800 SUBMENU REQUIRED VALUES | |
|-------------|---------------------------------|--|

The changeover between 1st and the 2nd required value can be done internally or externally via the digital inputs. With the following parameters the source of the required values and the change over can be configured.

| | | |
|-------------|-----------------------------|--------------------------------|
| 0805 | 0805 C.REQ.VAL 1 digital | Configuration required value 1 |
|-------------|-----------------------------|--------------------------------|

| | | | |
|--------------------|-------------------|-------------------|--|
| Possible settings: | - digital | - analog U 0-10V | <input checked="" type="checkbox"/> S |
| | - analog I 0-20mA | - analog I 4-20mA | |

| | |
|--------------------------|---|
| Digital | The internal required value 1 is used. Setting in the main menu in Parameter 02 or Parameter [0820]. |
| analog U=0 – 10V | The required value 1 is determined by the value of a voltage signal (0 – 10V) connected to terminals X3/13- X3/14 (GND). |
| analog I=0 – 20mA | The required value 1 is determined by the value of a current signal (4 – 20mA or 0 – 20mA) connected to terminals X3/18- X3/17 (GND). |
| analog I=4 – 20mA | <u>Notice:</u> If the incoming current signal falls below 4mA (4-20mA setting), a warning message is shown on the display. If the failure is still active after 20 seconds, an error message will be shown. |

| | | |
|-------------|-------------------------|--------------------------------|
| 0810 | 0810 C.REQ.VAL 2 OFF | Configuration required value 2 |
|-------------|-------------------------|--------------------------------|

| | | | |
|--------------------|-------------------|-------------------|------------------|
| Possible settings: | - OFF | - digital | - analog U 0-10V |
| | - analog I 0-20mA | - analog I 4-20mA | |

| | |
|--------------------------|---|
| OFF | Required value 2 is not used. |
| digital | The internal required value 2 is used. Setting in the main menu in Parameter 02 or Parameter [0825]. |
| analog U 0 – 10V | The required value 2 is determined by the value of a voltage signal (0 – 10V) connected to terminals X3/15- X3/16 (GND). <input checked="" type="checkbox"/> S |
| analog I 0 – 20mA | The required value 2 is determined by the value of a current signal (4 – 20mA or 0 – 20mA) connected to terminals X3/23- X3/22 (GND). <input checked="" type="checkbox"/> S |
| analog I 4 – 20mA | <u>Notice:</u> If the incoming current signal falls below 4mA (4-20mA setting), a warning message is shown on the display. If the failure is still active after 20 seconds, an error message will be shown. |



| | | | |
|------|--------------------------------|--|---------------------------------------|
| 0815 | 0815 SW REQ. VAL Setpoint 1 | Switching between required value 1 and 2 | <input checked="" type="checkbox"/> S |
|------|--------------------------------|--|---------------------------------------|

| | | |
|--------------------|----------------|----------------|
| Possible settings: | - Setpoint 1 | - Setpoint 2 |
| | - Switch Dig 1 | - Switch Dig 2 |
| | - Switch Dig 3 | - Switch Dig 4 |

Setpoint 1: Only required value 1 is active (No switching possible)
Setpoint 2: Only required value 2 is active (No switching possible)
Switch Dig 1: Manual switching by closing digital input 1 (X3/9-10)
Switch Dig 2: Manual switching by closing digital input 2 (X3/6-10)
Switch Dig 3: Manual switching by closing digital input 3 (X3/5-10)
Switch Dig 4: Manual switching by closing digital input 4 (X3/15-16)

| | | |
|------|----------------------------|----------------------------|
| 0820 | 0820 REQ.VAL.1 XX.X Bar | Required value 1 (digital) |
|------|----------------------------|----------------------------|

| | |
|--------------------|--|
| Possible settings: | 0.0 – to the pre selected Sensor range |
|--------------------|--|

Set the required value with either ▲ or ▼.

This pre-selected required value is active in mode cascade relay and cascade serial if parameter C.REQ.VAL.1 [0805] is set to digital, and parameter SW REQ.VAL. [0815] is set to setpoint 1 or the REQUIRED VALUE 1 is chosen via digital input.

This pre-selected required value could also be taken over in the main menu with parameter REQUIRED VAL. [02] if the current required value is active.

| | | |
|------|----------------------------|----------------------------|
| 0825 | 0825 REQ.VAL.2 XX.X Bar | Required value 2 (digital) |
|------|----------------------------|----------------------------|

| | |
|--------------------|--|
| Possible settings: | 0.0 – to the pre selected sensor range |
|--------------------|--|

Set the desired required value with either ▲ or ▼.

This pre-selected required value is active in mode cascade relay and cascade serial if parameter C.REQ.VAL.2 [0810] is set to digital, and parameter SW REQ.VAL. [0815] is set to setpoint 2 or the REQUIRED VALUE 2 is selected via digital input.

This pre-selected required value could also be taken over in the main menu with parameter REQUIRED VAL. [02] if the current required value is active.

| | | |
|-------------|------------------------------|-----------------------------------|
| 0830 | 0830 ACTUAT.FRQ 1 XX.X Hz | Required frequency 1 for actuator |
|-------------|------------------------------|-----------------------------------|

| | |
|--------------------|-------------------------|
| Possible settings: | 0.0 – MAX. FREQ. [0245] |
|--------------------|-------------------------|

Set the frequency with either ▲ or ▼

The selected frequency in this parameter is only active in the actuator mode if parameter C.REQ.VAL.1 [0805] is set to digital, and parameter SW REQ.VAL [0815] is set to setpoint 1 or the ACTUATOR FREQUENCY 1 is selected via digital input.

| | | |
|-------------|------------------------------|-----------------------------------|
| 0835 | 0835 ACTUAT.FRQ 2 XX.X Hz | Required frequency 2 for actuator |
|-------------|------------------------------|-----------------------------------|

| | |
|--------------------|-------------------------|
| Possible settings: | 0.0 – MAX. FREQ. [0245] |
|--------------------|-------------------------|

Set the frequency with either ▲ or ▼

The selected frequency in this parameter is only active in the actuator mode if parameter C.REQ.VAL.2 [0810] is set to digital, and parameter SW REQ.VAL [0815] is set to setpoint 2 or the ACTUATOR FREQUENCY 2 is selected via digital input.



| | | |
|-------------|-----------------------|--|
| 1100 | 1100 SUBMENU SETUP | |
|-------------|-----------------------|--|

| | | |
|-------------|-------------------------|-----------------------------------|
| 1120 | 1120 PASSWORD 2 0000 | Enter password by pressing ▲ or ▼ |
|-------------|-------------------------|-----------------------------------|

The below mentioned parameters are available after entering the password!
For more information, contact your distributor!

| | | |
|-------------|---------------------------|--|
| 1125 | 1125 CLR ERRORS UNIT X | Clear error memory of selected unit or ALL units (Cascade Serial) |
|-------------|---------------------------|--|

| | |
|--------------------|------------|
| Possible settings: | 1 – 8, ALL |
|--------------------|------------|

To clear the error memory either of one specific unit (1-8) or ALL units can be selected.
For reset press ► button till "RESET" appears.

| | | |
|-------------|----------------------------|--|
| 1130 | 1130 CLR MOTORH. UNIT X | Clear motor hours for selected unit or for ALL (Cascade Serial) |
|-------------|----------------------------|--|

| | |
|--------------------|------------|
| Possible settings: | 1 – 8, ALL |
|--------------------|------------|

Set desired unit where the Motor Hours should be cleared (or ALL) and press ► button till "RESET" appears.

| | | |
|-------------|------------------------------------|----------------------|
| 1135 | 1135 CLR OPERAT. Press ► 5 sec. | Clear operation time |
|-------------|------------------------------------|----------------------|

The operation time indicates the total time the HYDROVAR is connected to power supply.
For reset the operation time of the current HYDROVAR press ► button till "RESET" appears.

| | | |
|-------------|---------------------------------|--|
| 1200 | 1200 SUBMENU RS485-INTERFACE | |
|-------------|---------------------------------|--|

User Interface

The following 3 Parameters are necessary for communication between the HYDROVAR and an external device (e.g. PLC) via standardized Modbus-protocol. Set desired address, Baudrate and Format according the system requirements.

| | | |
|-------------|-------------------|--|
| 1205 | 1205 ADDRESS 1 | Set desired address for the user interface |
|-------------|-------------------|--|

| | |
|--------------------|---------|
| Possible settings: | 1 - 247 |
|--------------------|---------|

| | | |
|-------------|-----------------------|-----------------------------|
| 1210 | 1210 BAUDRATE 9600 | Baudrate for user interface |
|-------------|-----------------------|-----------------------------|

| | |
|--------------------|---|
| Possible settings: | 1200, 2400, 4800, 9600, 14400, 19200, 38400 |
|--------------------|---|

| | | |
|-------------|------------------------|---------------------------|
| 1215 | 1215 FORMAT RTU N81 | Format for user interface |
|-------------|------------------------|---------------------------|

| | |
|--------------------|---|
| Possible settings: | RTU N81, RTU N82, RTU E81, RTU O81, ASCII N72, ASCII E71, ASCII O71 |
|--------------------|---|

Internal Interface

If several Master Inverters are connected via the internal RS-485 interface (max. 8 / using cascade serial mode) each pump must be allocated its own pump-address number (1-8). **Each address may only be used once!**

| | | | |
|-------------|----------------------|--|---------------------------------------|
| 1220 | 1220 PUMP ADDR. 1 | Select desired address for the Master Inverter | <input checked="" type="checkbox"/> S |
|-------------|----------------------|--|---------------------------------------|

| | |
|--------------------|-----|
| Possible settings: | 1-8 |
|--------------------|-----|

Set desired address for the current Master Inverter and press ► button for approx. 5 sec. and the following messages will appear:

| | | | | |
|--------------------------|----|--------------------------|----|--------------------------|
| Addressing Addressing | -> | 1220 PUMP ADDR. * 1 * | or | 1220 PUMP ADDR. - 1 - |
|--------------------------|----|--------------------------|----|--------------------------|

Addressing done

Addressing failed - retry

When using Master and Basic Inverters together in a multi-pump-system you have to consider that the Basic Inverters have their separate address. Otherwise a correct function of the system couldn't be guaranteed.

For detailed Information see chapter 9.4.3.2 Addressing.

11 Failure messages



If the HYDROVAR is stopped by an error (warning), the HYDROVAR as well as the motor remain under voltage.

Before any work is carried out on the electrical or mechanical part of the system, the HYDROVAR must be disconnected from power supply.

Difference between warnings and errors:

- **Warnings** are shown on the display (and even by the red failure led) but it is possible that the HYDROVAR keeps running (depends to the different warnings). If a warning is active and the cause is not remedied within 20 seconds an error will be shown.
- **Errors** are indicated on the HYDROVAR and by the red failure LED placed on the control panel, and the connected motor is stopped immediately. All errors are shown on the display and saved in the error memory including date and time when the failure appeared.

The below mentioned points describe each error which can occur on the HYDROVAR (even on the Master and the Basic Inverter). Also the possible countermeasures to reset these errors are described.

- Please notice that an **automatic error-reset** can be activated in SUBMENU ERRORS to reset an occurred failure automatically for 5 times. For more information about this function see parameter ERROR-RESET [0615].
- All **error signals and warnings** can be also indicated at the two **status-relays** on terminals X5/1-2-3 or X5/4-5-6 depending on the configuration.
(How to program see parameter CONF REL 1 [0715] and CONF REL 2 [0720])

11.1 Basic Inverter

If the HYDROVAR is used as Basic Inverter (only the power unit), the following errors are indicated by the red LED:

| red LED Code | Error | Probability cause |
|--------------|------------------------------------|--|
| 1 blink | UNDERVOLTAGE | DC voltage of the HYDROVAR too low |
| 2 blinks | OVERCURRENT or OVERLOAD | Current rise at the output too high or power limit of the HYDROVAR is reached |
| 3 blinks | INVERTER OVERHEAT | Too high temperature inside the HYDROVAR |
| 4 blinks | OVERVOLTAGE | DC voltage of the HYDROVAR too high |
| 5 blinks | CODE ERROR | Internal error |
| 6 blinks | MOTOR OVERHEAT EXTERNAL CONTACT | PTC in the conduit box has reached its release temp. or external contact is open |

| | |
|---------------|--|
| Reset: | Resetting the CODE ERROR and the OVERCURRENT ERROR it is only possible to cut the power supply for > 60 seconds. A reset of all other errors can be done by open/close the START/STOP_PTC input (X1/PTC) on the power unit. |
|---------------|--|

If the **Basic Inverter is used in combination with a Master Inverter**, each failure can be indicated on the Master Inverter too and will be saved in the failure memory including date and time when the failure appeared.

| | |
|---------------------------|--|
| ERR. Basic Addr. X | Indication on the Master Inverter: For detailed failure information on the specific unit, SUBMENU STATUS [20] has to be entered and the affected device has to be selected! |
|---------------------------|--|

When a Master Inverter is used in such a system, it is also possible to reset the errors which occurred on the Basic Inverter by the Master without interfere the operation of the other Inverters in the system (also valid for automatic Error-reset).

11.2 Master / Single Inverter

Each error is shown on the display in plain text and saved in the error memory.

The errors can be reset automatically, depending on the setting in parameter ERROR-RESET [0615], or manually in different ways:

- cutting the power supply for > 60 seconds
- by pressing **◀** and **▶** simultaneously for about 5 seconds
- via External ON/OFF (Terminals X3/7-8)

| |
|--|
| No error-message on the display |
|--|

| Error | probable cause | measure |
|--|---|--|
| no AUTOSTART after power failure | Parameter AUTOSTART [08] is set to "OFF" | Check parameter AUTOSTART [08] |
| No operation even system pressure < set pressure | Pressure higher than the start value or REGULATION MODE has been changed to INVERS. | check parameter START VALUE [04] and/or REGULATION MODE [0320] |

| |
|-------------------------------------|
| Error-message on the display |
|-------------------------------------|

| Error | Probability cause | measure |
|---------------------------------|---|---|
| OVERCURRENT ERROR 11 | Current rise at the output too high | <ul style="list-style-type: none"> • check connection-terminals of the HYDROVAR • check the connection-terminal of the motor and the motor-cable • check the windings of the motor |
| Reset: | <ul style="list-style-type: none"> • disconnect from off the power supply for >60 seconds. • an automatic Error-reset isn't possible for that kind of failure! | |

| Error | Probability cause | measure |
|--------------------------------------|---|---|
| OVERLOAD ERROR 12 | Power limit of the HYDROVAR is exceeded | <ul style="list-style-type: none"> check Parameter RAMP 1/2 [0215/0220] (too short) and BOOST [0265] (too low) check motor connection (star/delta) and cable Pump blocked Motor turns in the wrong direction before running (Non return-valve defect) Not allowed operation point or MAX. FREQUENCY [0245] too high check also the BOOST [0265]. |
| OVERVOLTAGE ERROR 13 | DC voltage of the HYDROVAR too high | <ul style="list-style-type: none"> Parameter RAMP 2 [0220] too fast Power supply too high Voltage peaks too high (Solution: Line filters, Line inductance, RC-element) |
| INVERT. OVERHEAT ERROR 14 | too high temperature inside the HYDROVAR | <ul style="list-style-type: none"> no proper cooling contamination of the motor vents ambient temperature too high |
| THERMO MOT/EXT ERROR 15 | An external protective device connected to terminal X1/PTC has released (e.g. PTC which is connected has reached its release temperature) | <ul style="list-style-type: none"> close X1/PTC if there is no external protective device connected close external on/off switch if connected to these terminals For detailed information how the terminal X1/PTC could be used see chapter 9.4.3 |
| PHASELOSS ERROR 16 | One phases of the power supply has been lost -> automatic power reduction (just available for the units HV4.055-4.110) | <ul style="list-style-type: none"> check power supply under full load – check if phase failure at the input check circuit breakers visual inspection of points at the input terminals |
| UNDERVOLTAGE | DC voltage of the HYDROVAR too low | <ul style="list-style-type: none"> supply voltage too low phase failure at the input asymmetry of the phases |
| COMM LOST | The communication between the Power Unit and the control card doesn't work correctly | <ul style="list-style-type: none"> check if the addressing of Basic Inverter [DIP SW.] has been done correctly (retry!) check if each unit has allocated his own pump address check if the connection from control card to the power unit is made properly (ribbon cable) |

| | |
|---|---|
| Reset: | <ul style="list-style-type: none"> • cutting off the power supply for >60 seconds • manual reset by closing external ON/OFF (Terminals X3/7-8) • manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds • Auto-reset possible if ERROR-RESET [0615] is set to ON |
| LACK OF WATER ERROR 21 | <p>Low water contact (X3/11-12) is opened (just active if motor is running)</p> <ul style="list-style-type: none"> • incoming pressure or min. level too low • bridge X3/11-12, if there is no ext. low water protection • adjust Parameter DELAY TIME [0610] if the failure happens only for short time |
| Reset: | <ul style="list-style-type: none"> • Automatically if low water contact (X3/11-12) will be closed! |
| MIN. THRESHOLD ERROR 22 | <p>defined value of parameter MIN.THRESHOLD [0605] was not reached during the pre-selected DELAY-TIME [0610]</p> <ul style="list-style-type: none"> • check booster unit, adjust parameter DELAY TIME [0610] • Parameter ERROR RESET [0615] set to ON, to enable 5 restarts (e.g. in empty system) |
| FAILURE SENSOR 1 | <p>Sensor signal on terminals X3/2 <4mA</p> <p><u>active Sensor:</u> WARNING (20 sec.)-> ERROR</p> |
| ACT. VAL. SENSOR 1 ERROR 23 | <p><u>non-active sensor:</u> WARNING</p> <ul style="list-style-type: none"> • ACTUAL VALUE signal (pressure transducer) faulty • wrong connection • Sensor or cable fault • check configuration of the sensors in submenu SENSORS [0400] |
| FAILURE SENSOR 2 | <p>Sensor signal on terminals X3/4 <4mA</p> <p><u>active Sensor:</u> WARNING (20 sec.)-> ERROR</p> |
| ACT. VAL. SENSOR 2 ERROR 24 | <p><u>non-active Sensor:</u> WARNING</p> <ul style="list-style-type: none"> • ACTUAL VALUE signal (pressure transducer) faulty • wrong connection • Sensor or cable fault • check configuration of the sensors in submenu SENSORS [0400] |
| SETPOINT 1 I<4mA | <p>Current signal input of required values is active, but no signal 4-20mA is connected</p> |
| SETPOINT 1 I<4mA ERROR 25 | <p>WARNING (20 sec.)-> ERROR</p> <ul style="list-style-type: none"> • check external analogue signal on terminals X3/17-18 • check configuration of the required values in Submenu REQUIRED VALUES [0800] |

| | | |
|---|--|--|
| SETPOINT 2 I<4mA | Current signal input of required values is active, but no signal 4-20mA is connected | <ul style="list-style-type: none"> check external analogue signal on terminals X3/22-23 |
| SETPOINT 2 I<4mA ERROR 26 | WARNING (20 sec.)-> ERROR | <ul style="list-style-type: none"> check configuration of the required values in Submenu REQUIRED VALUES [0800] |

| | |
|---------------|--|
| Reset: | <ul style="list-style-type: none"> cutting off the power supply for >60 seconds manual reset by closing External ON/OFF (Terminals X3/7-8) manual reset by pressing ◀ and ▶ simultaneously for about 5 seconds Auto-reset possible if ERROR-RESET [0615] is set to ON |
|---------------|--|

11.3 Internal errors

To quit the following errors you have to cut the power supply for >60 seconds. If the error message is still shown on the display, contact customer service and provide a detailed description of the error.

| Internal errors Error-message on the display - red LED on | | |
|--|--|---|
| ERROR 1 | EEPROM-ERROR (data block malfunction) | Reset - after repeated error-message ⇒ change control card |
| ERROR 4 | Button error (e.g.: jammed key) | <ul style="list-style-type: none"> check push buttons, Display-board may be defect |
| ERROR 5 | EPROM-error (Checksum error) | Reset - after repeated error-message ⇒ change control card |
| ERROR 6 | Program error: Watchdog error | Reset - after repeated error-message ⇒ change control card |
| ERROR 7 | Program error: Processor pulse error | Reset - after repeated error-message ⇒ change control card |
| CODE ERROR | Code error: invalid processor command | <ul style="list-style-type: none"> check the installation of the cables, connection of the screen and potential equalization check earth/ground install additional inductances for the signal-cables (e.g. ferrites) |

Examples:

| Booster unit | |
|---|--|
| Problem: no stop of the HYDROVAR | |
| Parts to check | measure |
| <ul style="list-style-type: none"> • existing demand • non return valve is not closed • pre charge pressure in the pressure tank • no correct settings of WINDOW and RAMPHYSTERESIS • shut down ramp too slow • suction line too long | <ul style="list-style-type: none"> • check pipes and valves • change non return valve • adjust according the diagram • set WINDOW [0310] (ca.10%) and HYSTERESIS [0315] (80-50%) • set RAMP 2 [0220] to 4...15 sec. • the MINIMUM FREQUENCY [0250] should be activated for pressure increase at 0 demand |

| Control on constant flow | |
|--|--|
| Problem: control fluctuations | |
| Parts to check | measure |
| control characteristics are set to low | enlarger WINDOW [0310] and set HYSTERESIS [0315] to 99% to control with RAMP 3 and 4 |

| Circulating pump | |
|--|--|
| Problem: oscillation of the motor speed | |
| Parts to check | measure |
| control settings too fast | <ul style="list-style-type: none"> • increase RAMP 3 [0225] and 4 [0230]: 100...200sec • WINDOW [0310] (ca.20%) and HYSTERESIS [0315] (ca.99%) |
| Problem: ACTUAL VALUE can't be hold | |
| Parts to check | measure |
| HYSTERESIS is set too big | HYSTERESIS [0315]: 90-99% |

| General | |
|-----------|---|
| Problem: | pressure fluctuations, analogue signal not constant |
| Solution: | <ul style="list-style-type: none"> • check cables and connection of the screen • check earth connection of the transmitter cable • use screened cables |

12 Maintenance

The HYDROVAR does not require any special maintenance.

However, the cooling fan and the vents should be freed of dust occasionally. Also the temperature around the unit should be checked from time to time.

All modifications must be done by qualified personnel! For mounting and repairs at the HYDROVAR, qualified service technicians are available.

Demounting:

The HYDROVAR must be disconnected from the power supply before any work can be carried out. Consider at the pump- and motor-instruction.

Please take your personal protection equipment.

For further information, please ask your distributor!

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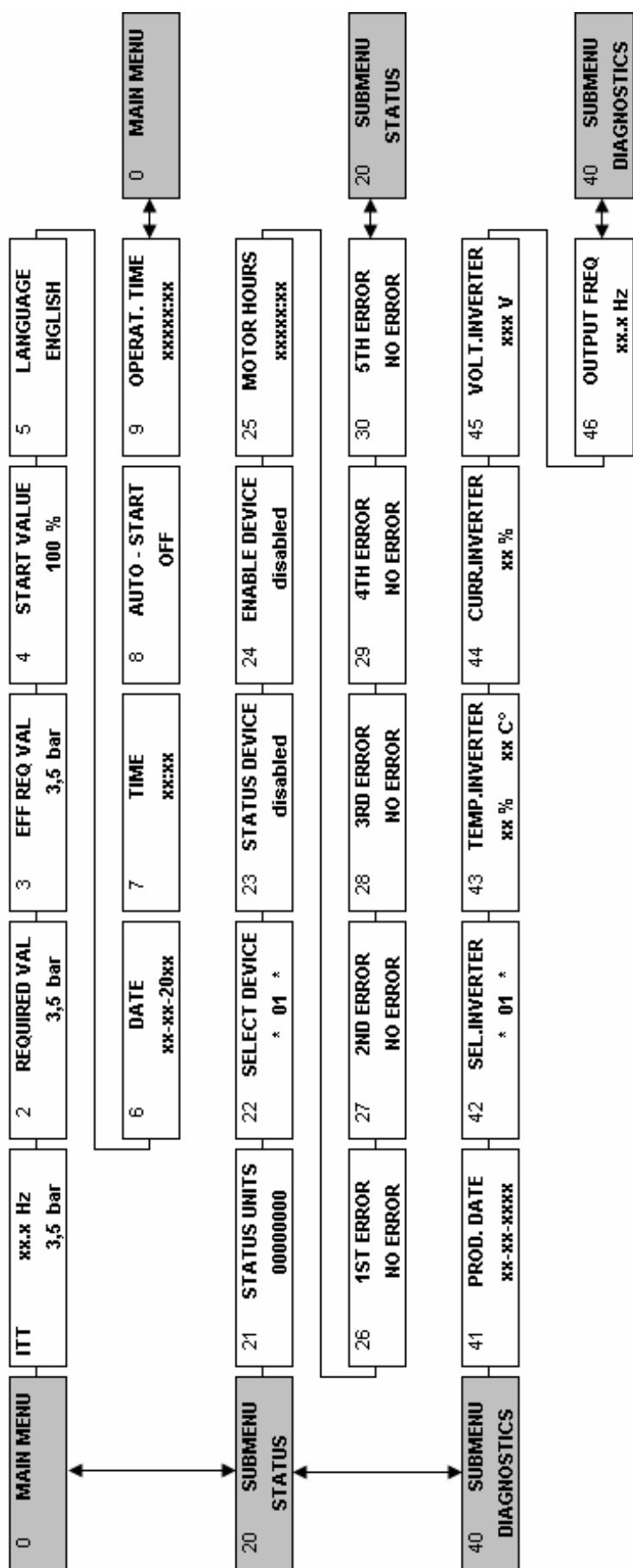
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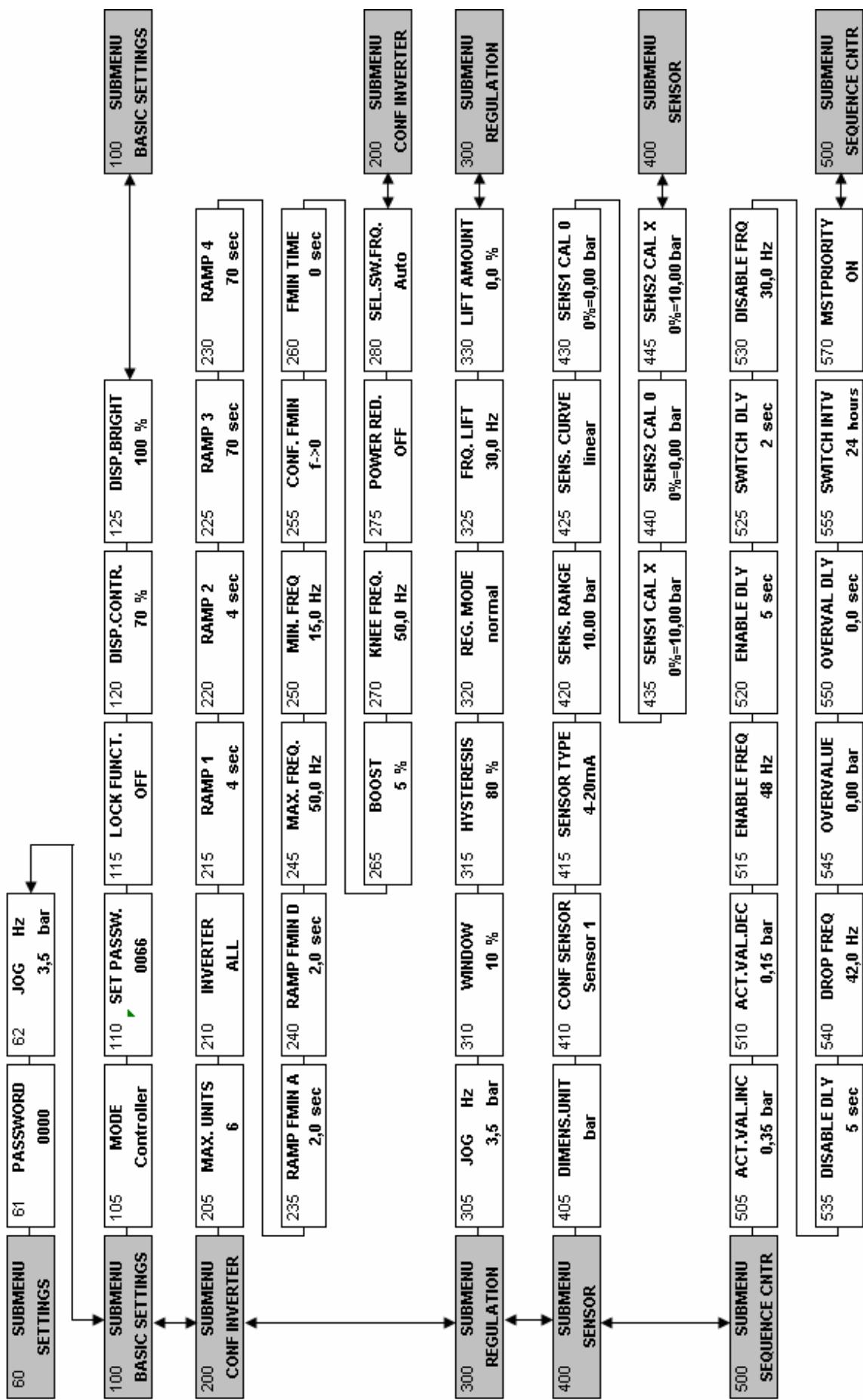
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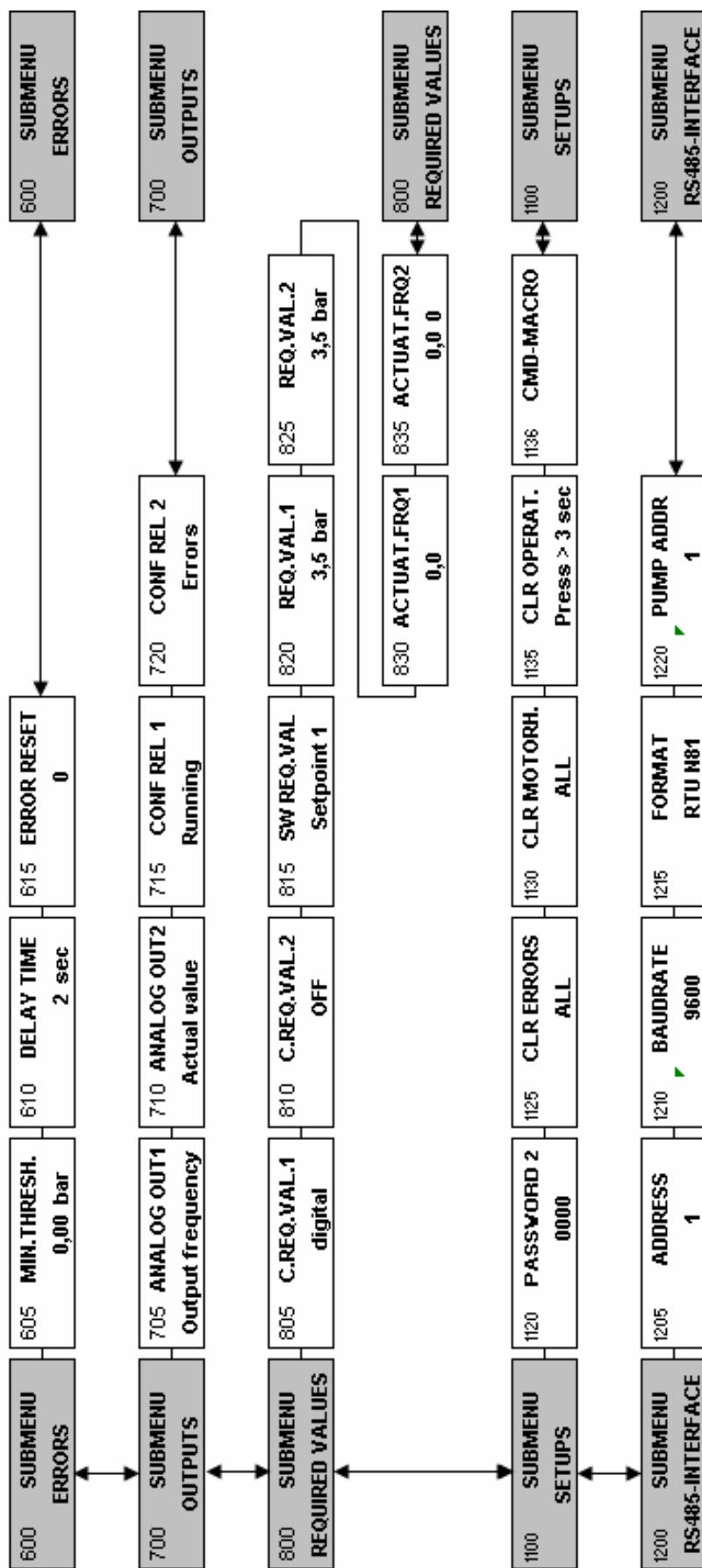
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